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**49TH ANNUAL TARGETS, UAVS & RANGE OPERATIONS SYMPOSIUM & EXHIBITION**

*“Budgets Impacts on Test and Training”*

**Fort Walton Beach, FL**

**October 25-27, 2011**

**Agenda**

**Wednesday, October 26, 2011**

**KEYNOTE ADDRESS**

- Maj Gen David J. Eichhorn, USAF, Commander, Air Force Operational Test and Evaluation Center, Kirtland AFB

**SESSION I: RANGES AND RANGE OPERATIONS**

**The Electronic Combat Range: The West Coast NAVAIR Electronic Warfare Range Complex**

- Mr. Joseph Albert, Section Head, Electronic Combat Range Test Management, NAVAIR, China Lake

**P5CTS: The Vector for Air Combat Training**

- Mr. Randall King, Aerospace Engineer, AAC/EBYI, Eglin AFB

**Outlaw ER**

- Mr. Greg Chando, Aeronautical Engineer, Griffon Aerospace

**Overview: Marine Corps Operational Test & Evaluation Activity (MCOTEA)**

- Mr. Kenneth Lardie, Division Head, Expeditionary Test Division, Marine Corps Operational Test & Evaluation Activity

**ATEC Re-organization and Support to the Test Ranges**

- Mr. Allen Tyler, Threat Combat Developer and Senior Threat Coordinator, Test & Evaluation Directorate, U.S.Army Test & Evaluation Command (ATEC), Aberdeen Proving Ground

**Joint Standard Target Control System Interface (JSTCSI)**

- Mr. Dae Hong, Head, Target Systems Division, NAVAIR Weapons Division, Pt. Mugu

**Range Encroachment Defense**

- Mr. Steve Shegrud, Senior Manager, Range Resources, Analysis & Tools, Whitney, Bradley & Brown, Inc.

**SESSION II: NEW TECHNOLOGY**

**Some Enabling Technologies**

- Mr. Brad Westphal, Director of Business Development, Honeywell Aerospace - Defense & Space

**Supersonic Aerial Target (SSAT) 167X**

- Mr. Bret Torgerson, SSAT Program Manager, Composite Engineering, Inc.

#### **Introduction to the Army Common Control System (ACCS)**

- Mr. Barry Hatchett, Lead Project Director, PEO STRI Targets Management Office, Redstone Arsenal

#### **K-MAX: Robotic Helicopter Operations**

- Mr. Edward “Bud” Sauvageau, Senior Analyst, Lockheed Martin Corporation, Mission Systems and Sensors (MS2)

#### **Tri-Service Directed Energy Update**

- Mr. Doug Weatherford, Senior Advisor, PEO Simulations, Training and Instrumentation, PM Instrumentation, Targets and Threat Simulators, Instrumentation Management Office (PM ITTS-IMO)

#### **Hubert D. Harris Scholarship Program Update**

- Mr. Cort Proctor, Consultant, Micro Systems, Inc.; Chairman, Scholarship Program, NDIA Targets Division

**Thursday, October 27, 2011**

#### **Keynote Address**

- Mr. Dyke Weatherington, Deputy Director, Unmanned Warfare, Portfolio Systems Acquisition, Office of the Under Secretary of Defense (OUSD) for Acquisition, Technology and Logistics (AT&L) and the Office of the Assistant Secretary of Defense for Acquisition

#### **SESSION III: CURRENT DEVELOPMENTS**

##### **QF-16 Developments**

- Dr. Kevin Wise, Senior Technical Fellow, The Boeing Company

##### **Common Range Integrated Instrumentation System (CRIIS) Update**

- Mr. Christopher Hughes, Program Manager, CRIIS Program Office, AAC/EBYC, Eglin AFB

##### **Land and Surface Target Scorer: Results From 2011 Proof of Concept Firing Trials**

- Mr. Gary Kemp, Program Director, Missile Scoring, Cambridge Consultants

##### **Target Support to Test Events in a Resource Constrained Environment: The Navy’s Way Forward**

- CAPT W.J. Jensen, USN, Navy Ranges and Targets Branch Head, OPNAV N433

##### **Aerial Weapon Scoring System (AWSS) Future Integration: Radar Rocket Scoring and Data Capture**

- Mr. Derek Foster, Program Director, Electronic Systems, Meggitt Defense Systems, Inc.

##### **Spectrum Processes: What Does it Take to Radiate?**

- Mr. Joe Giangrosso, RF Spectrum Engineer, 96 CS/SCXF, Eglin AFB

##### **F-16 & F-4: From Boneyard to Drone**

- Mr. Jeff Peterson, Director, Business Development, 309 AMARG, Davis-Monthan AFB

#### **SESSION IV: MILITARY PROGRAMS AND REQUIREMENTS**

##### **U.S. Air Force**

- Ms. Holly Reedy, Chief, Full-Scale Targets, Aerial Targets Program Office, Eglin AFB

##### **U.S. Army**

- Mr. Bruce Truog, Deputy Director, Targets Management Office, Redstone Arsenal

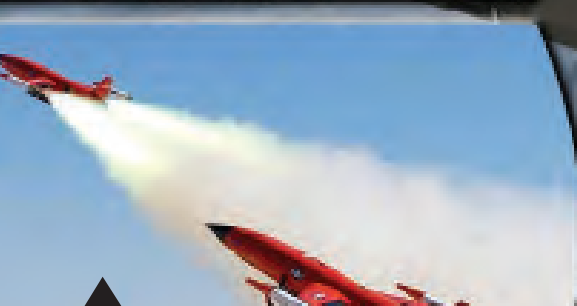
##### **U.S. Navy**

- CAPT Daniel McNamara, USN, Program Manager, Aerial Target and Decoy Systems, PMA-208, Patuxent River



# *49th ANNUAL* **TARGETS, UAVS & RANGE OPERATIONS SYMPOSIUM & EXHIBITION**

*“Budget Impacts on Test and Training”*



**OCTOBER 25-27, 2011**

**EMERALD COAST CONVENTION CENTER ► FORT WALTON BEACH, FL**

**[WWW.NDIA.ORG/MEETINGS/2410](http://WWW.NDIA.ORG/MEETINGS/2410)**

**EVENT #2410**

## LODGING

Four Points by Sheraton  
1325 Miracle Strip Parkway  
Fort Walton Beach, FL 32548  
(800) 874-8104

## GOLF TOURNAMENT

Eglin AFB Eagle Golf Course  
1527 Fairway Drive  
Niceville, FL 32578-6901  
(850) 678-8726

Please join us on Tuesday, October 25, 2011 for a fun-filled golf outing to raise funds for the Hubert D. Harris Scholarship Program. Tee times will begin at 12:00 PM at the Eglin AFB Eagle Golf Course. This is a great course, ranked #3 among all military golf courses. All skill levels are welcome and encouraged to participate in this fun-filled day!

A fee of \$75 (includes green fees, cart, and lunch) is required to participate in the tournament. To rent clubs, please contact the golf course directly at: (850) 678-8726.

## SYMPOSIUM THEME

The 49th Annual Symposium will bring together recognized experts from government, military, and industry to showcase the latest developments in Targets, UAVs and Range Operations. As threats and weapons systems evolve and robotics become ever more prominent in warfare, training and testing for these advanced scenarios becomes increasingly critical. Questions of threat replication and fidelity versus the realities of cost and funds availability make the planner's role in product selection difficult.

Join us to address these realities through presentations on cutting edge developments: standardizing interfaces of joint control systems, the role of micro robotic air vehicles, testing of new target technologies on U.S. and allied ranges, and the challenges of making these systems affordable for the end user.

## WILLIS HOWARD AWARD

The Willis Howard Award is presented annually at the symposium to the person, either corporate or military, who in the view of the NDIA Targets Division Executive Board, has demonstrated both sustained superior service within the communities now represented by the NDIA Targets Division, as well as active service to the Division.

Named after Mr. Willis Howard, one of the founding owners of Cartwright Electronics (now a division of Meggitt Defense Systems, Inc.), it is the highest award presented within the Targets community. Willis was also one of the founding corporate members of the NDIA Targets Division, which was originally the Aerial Targets Division of the American Ordnance Association. He was an extremely active member of the Division who presented papers, chaired Sessions, and was Chairman of the Annual Symposium on two occasions.

Willis was killed in an auto accident while working with the USAF Weapons Evaluation Group at Tyndall Air Force Base. He was so well respected throughout the Targets community that the Division implemented an award in his honor.

## HUBERT D. HARRIS SCHOLARSHIP PROGRAM & MEMORIAL GOLF TOURNAMENT

The Hubert D. Harris Scholarship Program was established in 1991 to memorialize Mr. Hugh Harris for his many contributions to the Targets community in both government and industry. The NDIA Targets Division has been joined by NDIA's Gulf Coast Chapter as a co-sponsor of the Scholarship Program.

Hugh was a longtime member and leader in various professional organizations including IEEE, AOC, and ADPA (forerunner of NDIA). He served two years as the National Chairman for the Aerial Targets and RPV Section, working closely with all three military services. Subsequent to his death on June 9, 1991, Hugh was the posthumous winner of the Division's Willis Howard Award for outstanding service.

The Scholarship is presented annually to a deserving high school senior who will be entering an accredited four-year university in pursuit of a math, engineering, or hard science degree. Profits from the Hubert D. Harris Memorial Golf Tournament supplement the \$50,000 base scholarship fund.

## TUESDAY, OCTOBER 25, 2011

- 11:00 AM - 6:30 PM**     **Registration Open**  
*Emerald Ballroom Foyer*
- 12:00 PM - 5:00 PM**     **Hubert D. Harris Memorial Golf Tournament**  
*Eglin AFB Eagle Golf Course - Registration Required*
- 5:30 PM - 6:30 PM**     **Welcome Reception (Hosted Beer and Wine)**  
*Emerald Ballroom I&II - Exhibit Hall*

## WEDNESDAY, OCTOBER 26, 2011

- 7:00 AM - 5:15 PM**     **Registration Open**  
*Emerald Ballroom Foyer*
- 7:00 AM - 8:00 AM**     **Continental Breakfast**  
*Emerald Ballroom I&II - Exhibit Hall*
- 8:00 AM - 8:10 AM**     **Welcome Remarks and Keynote Speaker Introduction by Symposium Co-Chairmen**  
*Emerald Ballroom III&IV*
  - ▶ Mr. Al Brown, Director, Targets Management Office, Redstone Arsenal; Symposium Co-Chairman, NDIA Targets Division
  - ▶ Mr. Craig Tangedal, Vice President, 5-D Systems, Inc.; Symposium Co-Chairman, NDIA Targets Division
- 8:10 AM - 8:50 AM**     **Keynote Address**  
*Emerald Ballroom III&IV*
  - ▶ Maj Gen David J. Eichhorn, USAF, Commander, Air Force Operational Test and Evaluation Center, Kirtland AFB

### SESSION I: RANGES AND RANGE OPERATIONS

- 8:50 AM - 9:00 AM**     **Introduction by Session Chair**  
*Emerald Ballroom III&IV*
  - ▶ Mr. Troy Bisbee, Director of Advanced Programs, Composite Engineering, Inc.
- 9:00 AM - 9:20 AM**     **The Electronic Combat Range: The West Coast NAVAIR Electronic Warfare Range Complex**  
*Emerald Ballroom III&IV*
  - ▶ Mr. Joseph Albert, Section Head, Electronic Combat Range Test Management, NAVAIR, China Lake
- 9:20 AM - 9:40 AM**     **P5CTS: The Vector for Air Combat Training**  
*Emerald Ballroom III&IV*
  - ▶ Mr. Randall King, Aerospace Engineer, AAC/EBYI, Eglin AFB

## KEYNOTE ADDRESS

Major General David J. Eichhorn, USAF



## LOCATION

Emerald Coast Convention Center  
1250 Miracle Strip Parkway, SE  
Fort Walton Beach, FL 32548  
(850) 609-3800

## REGISTRATION

Emerald Ballroom Foyer

## GENERAL SESSION

Emerald Ballroom III&IV

## EXHIBIT HALL

Emerald Ballroom I&II

## ATTIRE

Appropriate dress for the symposium is business casual for civilians and Class B uniform or uniform of the day for military personnel.

## ID BADGES

During symposium registration and check-in, each Attendee will be issued an identification badge. Please be prepared to present a valid picture ID. Badges must be worn at all symposium functions.

## DONATION

In lieu of Speaker gifts, a donation will be made to the Hubert D. Harris Scholarship Program.

- 9:40 AM - 10:00 AM Outlaw ER**  
*Emerald Ballroom III&IV*  
► Mr. Greg Chando, Aeronautical Engineer, Griffon Aerospace
- 10:00 AM - 10:45 AM Networking Break**  
*Emerald Ballroom I&II - Exhibit Hall*
- 10:45 AM - 11:05 AM ATEC Re-organization and Support to the Test Ranges**  
*Emerald Ballroom III&IV*  
► Mr. Allen Tyler, Threat Combat Developer and Senior Threat Coordinator, Test & Evaluation Directorate, U.S. Army Test & Evaluation Command (ATEC), Aberdeen Proving Ground
- 11:05 AM - 11:25 AM Joint Standard Target Control System Interface (JSTCSI)**  
*Emerald Ballroom III&IV*  
► Mr. Dae Hong, Head, Target Systems Division, NAVAIR Weapons Division, Pt. Mugu
- 11:25 AM - 11:45 AM Range Encroachment Defense**  
*Emerald Ballroom III&IV*  
► Mr. Steve Shegrud, Senior Manager, Range Resources, Analysis & Tools, Whitney, Bradley & Brown, Inc.
- 11:45 AM - 12:00 PM Willis Howard Award Presentation**  
*Emerald Ballroom III&IV*  
► Mr. David Miller, Business Development, Meggitt Defense Systems, Inc.; Chairman, NDIA Targets Division
- 12:00 PM - 1:30 PM Networking Lunch**  
*Emerald Ballroom I&II - Exhibit Hall*

## SESSION II: NEW TECHNOLOGY

- 1:30 PM - 1:40 PM Introduction by Session Chair**  
*Emerald Ballroom III&IV*  
► Mr. Steve Williams, Business Area Manager, Signal Instrumentation, RT Logic, Inc.
- 1:40 PM - 2:00 PM Some Enabling Technologies**  
*Emerald Ballroom III&IV*  
► Mr. Brad Westphal, Director of Business Development, Honeywell Aerospace - Defense & Space
- 2:00 PM - 2:20 PM Supersonic Aerial Target (SSAT) 167X**  
*Emerald Ballroom III&IV*  
► Mr. Bret Torgerson, SSAT Program Manager, Composite Engineering, Inc.

- 2:20 PM - 2:40 PM**      **Introduction to the Army Common Control System (ACCS)**  
*Emerald Ballroom III&IV*  
▶ Mr. Barry Hatchett, Lead Project Director, PEO STRI Targets Management Office, Redstone Arsenal
- 2:40 PM - 3:25 PM**      **Networking Break**  
*Emerald Ballroom I&II - Exhibit Hall*
- 3:25 PM - 3:45 PM**      **K-MAX: Robotic Helicopter Operations**  
*Emerald Ballroom III&IV*  
▶ Mr. Edward "Bud" Sauvageau, Senior Analyst, Lockheed Martin Corporation, Mission Systems and Sensors (MS2)
- 3:45 PM - 4:05 PM**      **Tri-Service Directed Energy Update**  
*Emerald Ballroom III&IV*  
▶ Mr. Doug Weatherford, Senior Advisor, PEO Simulations, Training and Instrumentation, PM Instrumentation, Targets and Threat Simulators, Instrumentation Management Office (PM ITTS-IMO)
- 4:05 PM - 4:15 PM**      **Hubert D. Harris Scholarship Program Update**  
*Emerald Ballroom III&IV*  
▶ Mr. Cort Proctor, Consultant, Micro Systems, Inc.; Chairman, Scholarship Program, NDIA Targets Division
- 4:15 PM - 5:15 PM**      **Networking Reception (Hosted Beer and Wine)**  
*Emerald Ballroom I&II - Exhibit Hall*

## THURSDAY, OCTOBER 27, 2011

- 7:00 AM - 3:20 PM**      **Registration Open**  
*Emerald Ballroom Foyer*
- 7:00 AM - 8:00 AM**      **Continental Breakfast**  
*Emerald Ballroom I&II - Exhibit Hall*
- 8:00 AM - 8:10 AM**      **Welcome Remarks and Keynote Speaker Introduction by Symposium Co-Chairmen**  
*Emerald Ballroom III&IV*  
▶ Mr. Al Brown, Director, Targets Management Office, Redstone Arsenal; Symposium Co-Chairman, NDIA Targets Division  
▶ Mr. Craig Tangedal, Vice President, 5-D Systems, Inc.; Symposium Co-Chairman, NDIA Targets Division
- 8:10 AM - 8:50 AM**      **Keynote Address**  
*Emerald Ballroom III&IV*  
▶ Mr. Dyke Weatherington, Deputy Director, Unmanned Warfare, Portfolio Systems Acquisition, Office of the Under Secretary of Defense (OUSD) for Acquisition, Technology and Logistics (AT&L) and the Office of the Assistant Secretary of Defense for Acquisition

### KEYNOTE ADDRESS

Mr. Dyke Weatherington





## NDIA EVENTS

Thank you for your interest in the Targets Symposium & Exhibition! We hope to see you at a future NDIA event. Please visit the NDIA website for a complete listing of the events we offer.

NDIA website:  
<http://www.ndia.org>

Select:  
Meetings & Events  
Schedule of Events

## ADVERTISING

Advertise in *National Defense* magazine and increase your organization's exposure. *National Defense* will be distributed to Attendees of this event, as well as other NDIA events. For more information, please contact Mr. Dino Pignotti, NDIA, at (703) 247-2541 or [dpignotti@ndia.org](mailto:dpignotti@ndia.org).

### SESSION III: CURRENT DEVELOPMENTS

- |                            |   |
|----------------------------|---|
| <b>8:50 AM - 9:00 AM</b>   | <b>Introduction by Session Chair</b><br><i>Emerald Ballroom III&amp;IV</i><br>► Mr. Josh Messner, T&E Resource Analyst, Office of the Secretary of Defense (OSD), DOT&E   |
| <b>9:00 AM - 9:20 AM</b>   | <b>QF-16 Developments</b><br><i>Emerald Ballroom III&amp;IV</i><br>► Dr. Kevin Wise, Senior Technical Fellow, The Boeing Company  |
| <b>9:20 AM - 9:40 AM</b>   | <b>Common Range Integrated Instrumentation System (CRIIS) Update</b><br><i>Emerald Ballroom III&amp;IV</i><br>► Mr. Christopher Hughes, Program Manager, CRIIS Program Office, AAC/EBYC, Eglin AFB                                    |
| <b>9:40 AM - 10:00 AM</b>  | <b>Land and Surface Target Scorer: Results From 2011 Proof of Concept Firing Trials</b><br><i>Emerald Ballroom III&amp;IV</i><br>► Mr. Gary Kemp, Program Director, Missile Scoring, Cambridge Consultants                            |
| <b>10:00 AM - 10:45 AM</b> | <b>Networking Break</b><br><i>Emerald Ballroom I&amp;II - Exhibit Hall</i>  |
| <b>10:45 AM - 11:15 AM</b> | <b>Target Support to Test Events in a Resource Constrained Environment: The Navy's Way Forward</b><br><i>Emerald Ballroom III&amp;IV</i><br>► CAPT W.J. Jensen, USN, Navy Ranges and Targets Branch Head, OPNAV N433                  |
| <b>11:15 AM - 11:45 AM</b> | <b>Aerial Weapon Scoring System (AWSS) Future Integration: Radar Rocket Scoring and Data Capture</b><br><i>Emerald Ballroom III&amp;IV</i><br>► Mr. Derek Foster, Program Director, Electronic Systems, Meggitt Defense Systems, Inc. |
| <b>11:45 AM - 12:05 PM</b> | <b>Spectrum Processes: What Does it Take to Radiate?</b><br><i>Emerald Ballroom III&amp;IV</i><br>► Mr. Joe Giangrosso, RF Spectrum Engineer, 96 CS/SCXF, Eglin AFB   |
| <b>12:05 PM - 12:25 PM</b> | <b>F-16 &amp; F-4: From Boneyard to Drone</b><br><i>Emerald Ballroom III&amp;IV</i><br>► Mr. Jeff Peterson, Director, Business Development, 309 AMARG, Davis-Monthan AFB  |
| <b>12:25 PM - 1:40 PM</b>  | <b>Networking Lunch (Last Chance to View Exhibits)</b><br><i>Emerald Ballroom I&amp;II - Exhibit Hall</i>   |

#### SESSION IV: MILITARY PROGRAMS AND REQUIREMENTS

- 1:40 PM - 1:50 PM**      **Introduction by Session Chair**  
*Emerald Ballroom III&IV*  
▶ Mr. Ken Hislop, QF-16 Program Manager, AAC/EBYA, Eglin AFB
- 1:50 PM - 2:10 PM**      **U.S. Air Force**  
*Emerald Ballroom III&IV*  
▶ Ms. Holly Reedy, Chief, Full-Scale Targets, Aerial Targets Program Office, Eglin AFB
- 2:10 PM - 2:30 PM**      **U.S. Army**  
*Emerald Ballroom III&IV*  
▶ Mr. Bruce Truog, Deputy Director, Targets Management Office, Redstone Arsenal
- 2:30 PM - 2:50 PM**      **U.S. Navy**  
*Emerald Ballroom III&IV*  
▶ CAPT Daniel McNamara, USN, Program Manager, Aerial Target and Decoy Systems, PMA-208, Patuxent River
- 2:50 PM - 3:00 PM**      **Concluding Remarks by Symposium Co-Chairmen**  
*Emerald Ballroom III&IV*  
▶ Mr. Al Brown, Director, Targets Management Office, Redstone Arsenal; Symposium Co-Chairman, NDIA Targets Division  
▶ Mr. Craig Tangedal, Vice President, 5-D Systems, Inc.; Symposium Co-Chairman, NDIA Targets Division
- 3:00 PM**                      **Symposium Adjourned**

#### SYMPOSIUM CONTACT

Ms. Meredith Geary, CMP  
Associate Director, NDIA  
(703) 247-9476  
mgeary@ndia.org

#### EXHIBITS CONTACT

Mrs. Alden Davidson, CEM  
Associate Director, Exhibits, NDIA  
(703) 247-2582  
adavidson@ndia.org

#### PROCEEDINGS

Proceedings will be available on the web through the Defense Technical Information Center (DTIC) two weeks after the symposium. All registered Attendees will receive an email notification once the proceedings are available.





## **Aerial Weapon Scoring System (AWSS)**

NDIA 49<sup>th</sup> Annual Targets, UAVs, and Range Operations Symposium

27 October 2011

**MEGGITT**

# What is AWSS

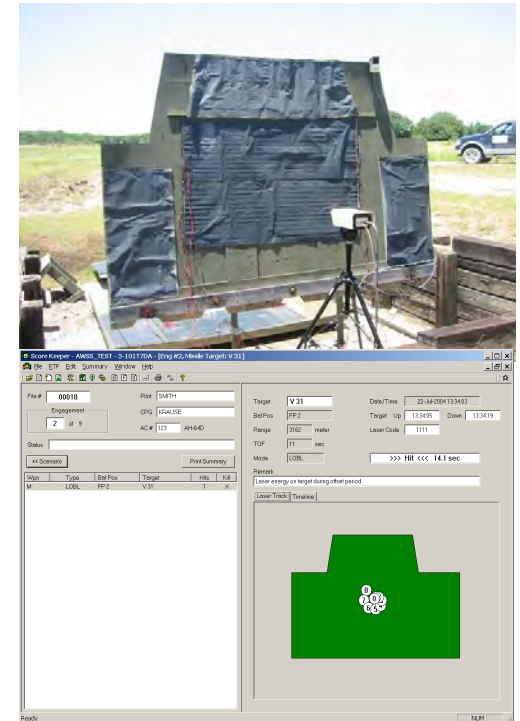
## Aerial Weapon Scoring System

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- » Scalable & portable system of computer controlled sensors used to score live-fire helicopter gunnery for evaluation of crew & weapons performance. This objective scoring system allows the commander to validate training standards, ensure training effectiveness, and substantiate training ammunition requirement levels.
- » Consists of:
  - Acoustic sensors for 2.75” rocket impact location
  - Radar sensors for cannon/machine gun scoring
  - IR/Optical sensors for laser designator detection & tracking when used with the Hellfire Captive Training missile
- » Seven fully portable systems delivered to the US Army for crew qualification gunnery training
- » Only fielded system worldwide for Attack Helicopter live fire training

# AWSS required operational capability

- » AWSS is the standard objective scoring method for all US Army AH-64 & OH-58 crew qualification gunnery tables (6-8)
- » Provide Commander with objective feedback of target effect for all Attack Helicopter weapons engagements
- » Operate Day and Night with no degradation or limitation due to environmental conditions that would not preclude training
- » Detect and score > 90% of all projectiles (rockets and bullets) in the target effect area (scored zone)
- » Maintain > 95% equipment availability rate
- » Sustain NO damage from environmental / EMI standard conditions for Army ranges & training devices



# AWSS background

---

- |                                      |              |
|--------------------------------------|--------------|
| » Original Requirement               | 1984         |
| » Prototype Operations (Ft Hood, TX) | 1986-90      |
| » Production Deliveries              | 1991         |
| » ECPs Incorporated                  | 1995-99      |
| » Upgrades Funded                    | 2000         |
| » Production Start                   | 2003         |
| » Fielding                           | 2004-07      |
| » Continuous System Enhancements     | 2007-present |
- 
- » Currently there are (4) Systems based at Ft. Hood, TX that are utilized for all US Army Attack Helicopter live-fire gunnery operations in North America. There is (1) System permanently based at Grafenwoehr, Germany, (1) System at Camp Casey, South Korea, and another (1) tailored system at Udairi, Kuwait.



# System packaging for portability



Aerial Weapon Scoring System NDIA 49th Annual Targets, UAVs and Range Operations Symposium

# AWSS benefits

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- » Every Weapon Engagement is scored to same standard
- » Target Effect of every Weapon Engagement is provided in near REAL-TIME
- » Every Weapon Engagement is documented
- » TTPs can be validated and standardized
- » Crew Performance Improves Dramatically
- » Training Resource Utilization is captured
- » Performance can be tracked
- » Crew Errors are separated from Bias Errors
  - Both can be identified and tracked
  - Weapons maintenance / bore sight accuracy improved
- » OBJECTIVE MEASUREMENT OF COMBAT READINESS!

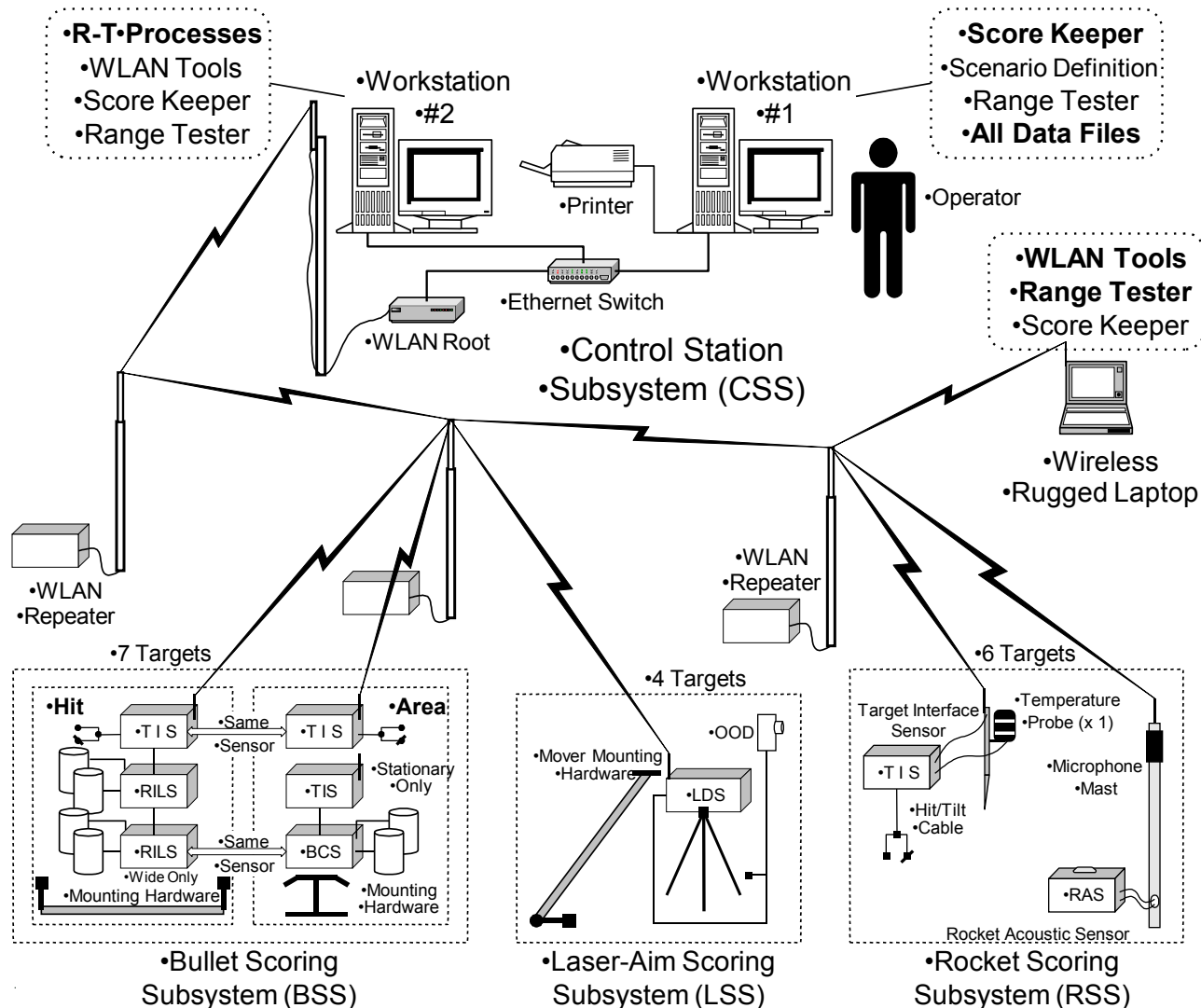
# AWSS subsystems

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- » **Control Station Subsystem (CSS)**
  - (CSS) Computers, Printer, WLAN Data Link, System Software
- » **Bullet Scoring Subsystem (BSS)**
  - 7.62mm, .50 cal, 20mm, 30mm, 40mm
  - Real-Time Hit Scoring (98% Detection/Location On-Target)
  - Area Scoring (98% Detection within 50X20 meters area)
- » **Laser-Aim Scoring Subsystem (LSS)**
  - LOAL and LOBL Missile Launch Modes
  - Real-Time Hit Indication
- » **Rocket Scoring Subsystem (RSS)**
  - PD (M274) and MPSM (M267) Rockets (90% Detection/Location within the TEA)
  - Real-Time Scoring with Target Effect (90% Detection/Location within the TEA)



# Subsystems and components



Aerial Weapon Scoring System NDIA 49th Annual Targets, UAVs and Range Operations Symposium

# Control Station Subsystem (CSS)

## » Workstation #1

- Primary Control Station for scoring engagements
- Holds all shared data including score files
- Only station requiring data back up

## » Workstation #2

- Runs Real-Time Processes automatically
- Performs sensor communication and rocket scoring
- Secondary scoring station (backup)

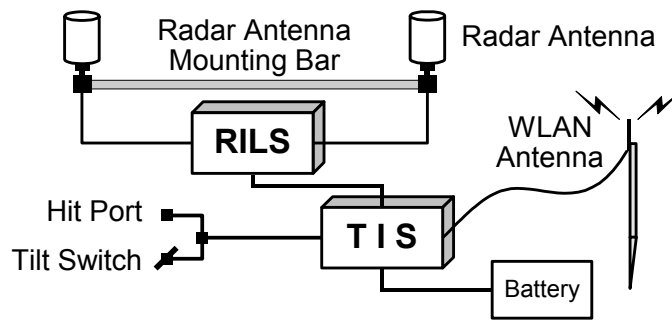
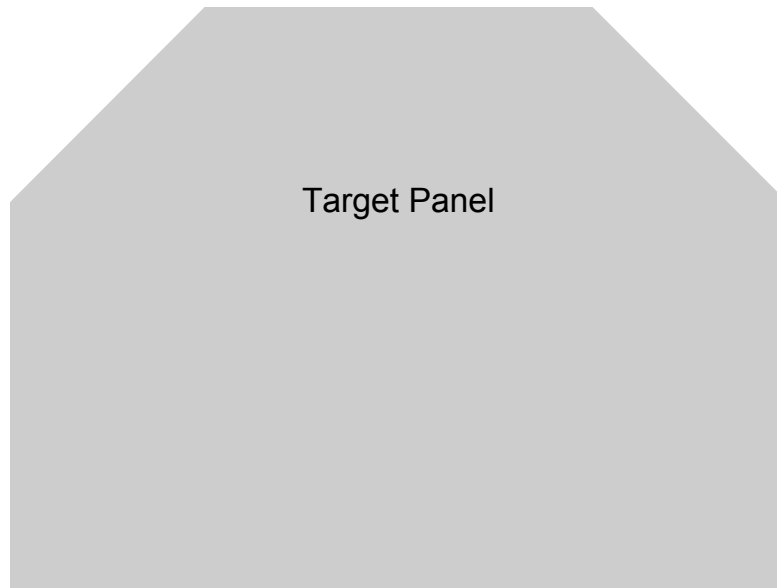
## » Rugged Laptop

- Supports downrange operations (setup/BIT)
- Remote scoring station
- May be used to observe engagement results in real time at remote location (tower)



# Bullet hit scoring stationary target

## Round Identification Location System (RILS)



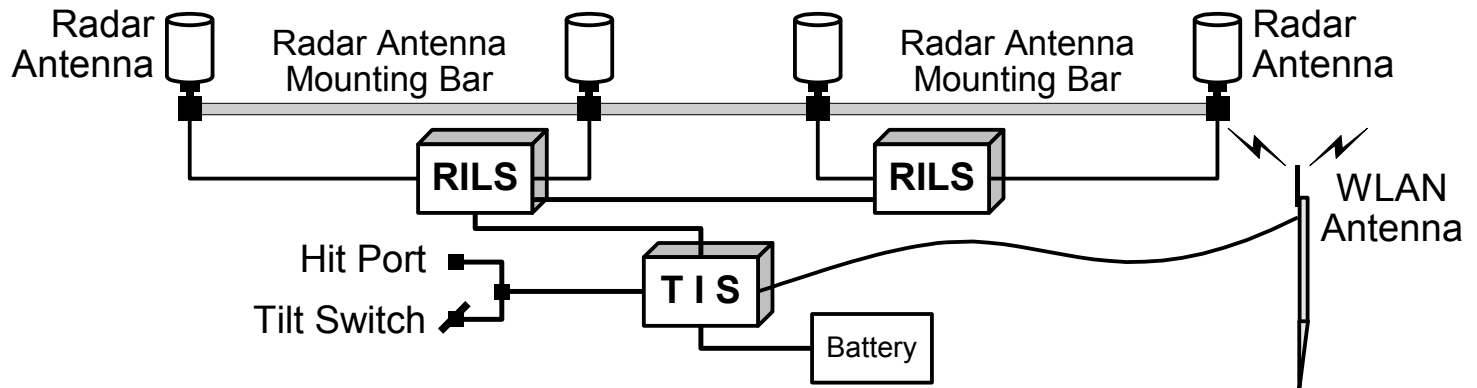
Round Identification & Location System (RILS)

Target Interface Sensor (TIS)

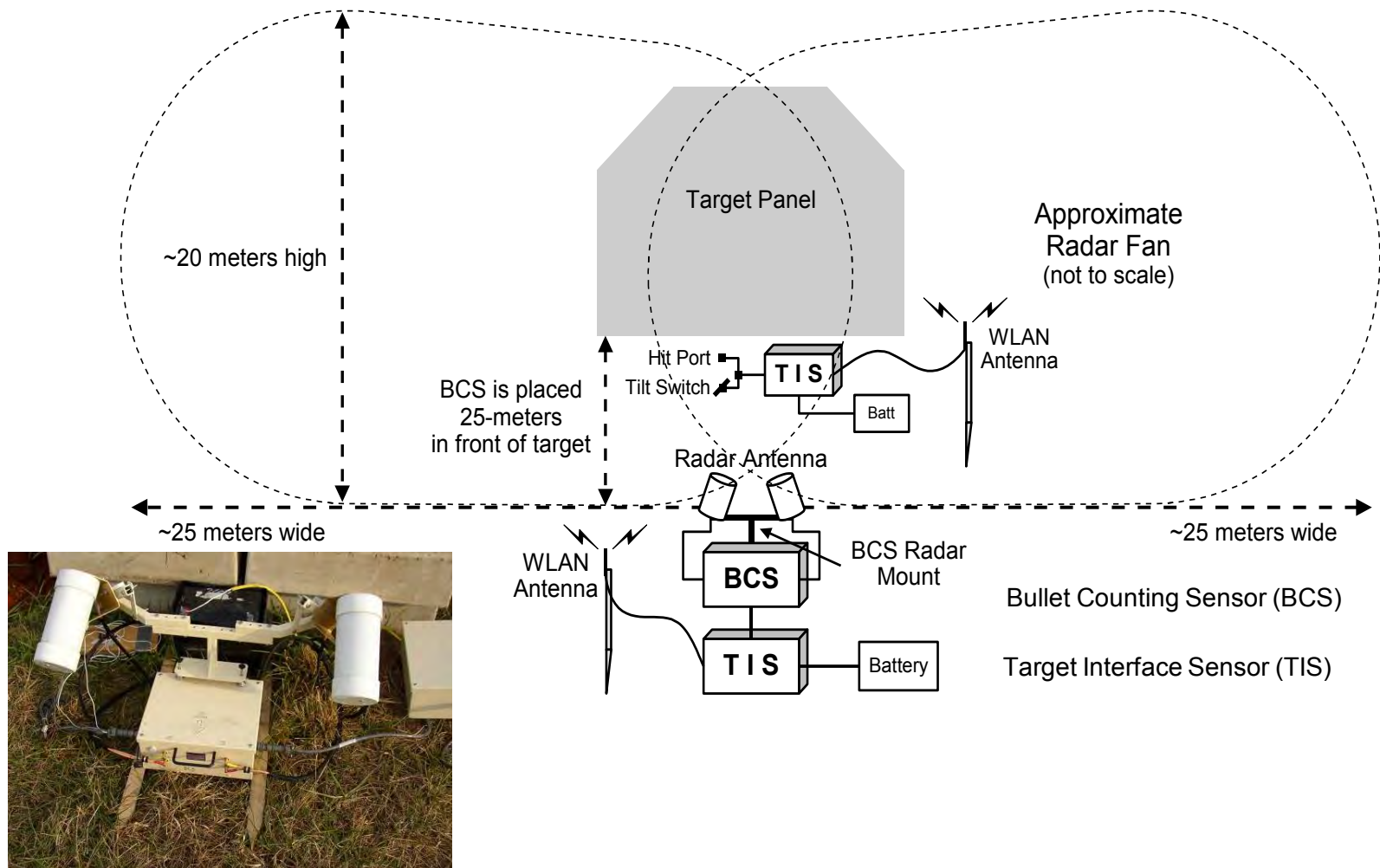
# Bullet hit scoring moving target



T-72 Silhouette  
Target Panel



# Bullet area scoring



# Bullet hit scoring display

Score Keeper - AWSS\_TEST - 3-101T7DH - [Eng #7, Bullet Target: V 23]

File RTP Edit Summary Window Help

File Edit RTP Summary Window Help

File # 00007 Pilot SMITH

Engagement 7 of 9 CPG KRAUSE

AC # 123 AH-64D

Status

<< Scenario Print Summary

Wpn	Type	Bat Pos	Target	Hits	Kill
B	30mm	FP 4	V 23	8	X

Target V 23

Bat Pos FP 4

Range 1750 meter

TOF 4.0 sec

Bullet(s) 30mm

Hits To Kill 1

Hit Count 8 Dets 25

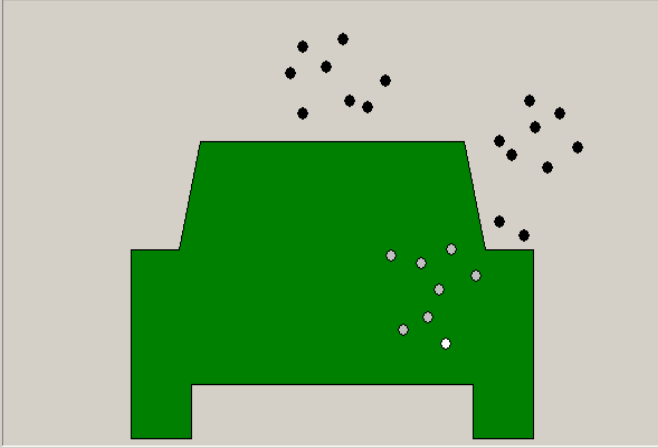
Date/Time 20-Jul-2004 13:49:33

Target Up 13:49:35 Down 13:49:41

Burst	Det Time	Dets	Hits
1	13:49:37.0	7	0
2	13:49:39.0	8	0
3	13:49:41.0	10	8

>>> Kill <<< 6.1 sec

T-72 Front



Ready NUM

# Bullet area scoring display

Score Keeper - AWSS\_TEST - 3-101T7DA - [Eng #1, Bullet Target: V 21]

File RTP Edit Summary Window Help

File # 00009 Pilot SMITH  
Engagement 1 of 9 CPG KRAUSE  
AC# 123 AH-64D

Status

<< Scenario Print Summary

Wpn	Type	Bat Pos	Target	Hits	Kill
B	.50cal	FP 2	V 21	15	X

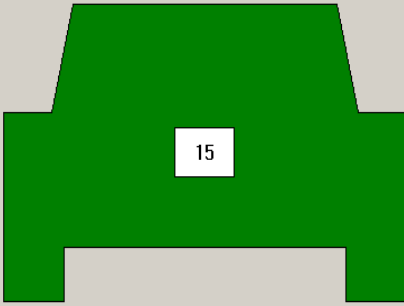
Target V 21  
Bat Pos FP 2  
Range 750 meter  
TOF 0.8 sec  
Bullet(s) .50cal  
Hits To Kill 8  
Hit Count 15

Date/Time 21-Jul-2004 08:06:32  
Target Up 08:06:34 Down 08:06:38

Burst	Det Time	Count
1	08:06:36.0	7
2	08:06:38.0	8

>>> Kill <<< 4.0 sec

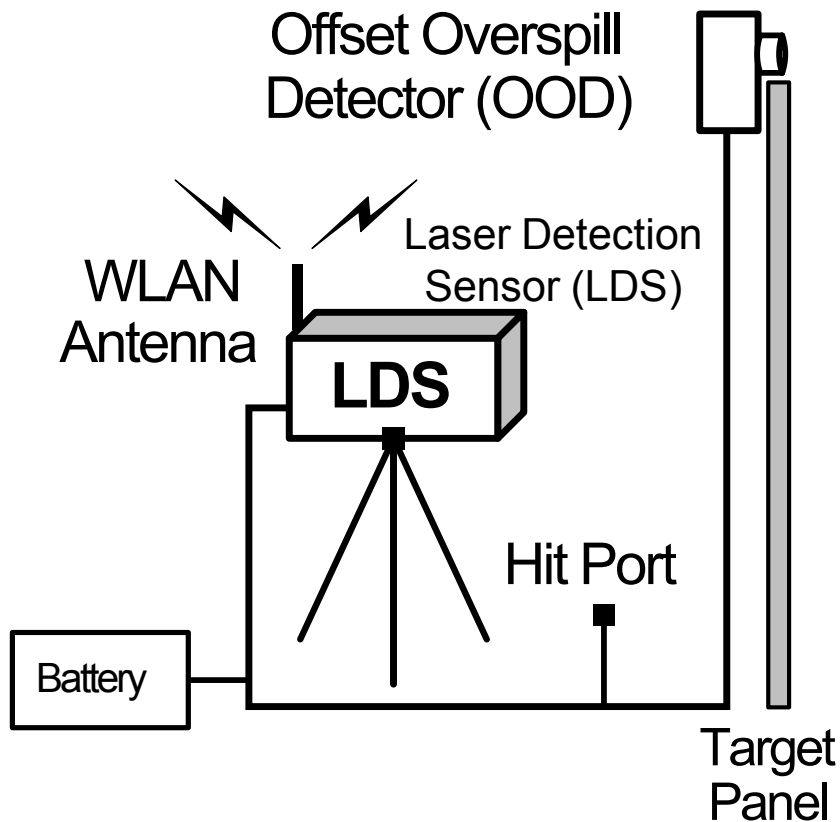
T-72 Front



Ready NUM



# Laser Scoring Subsystem (LSS)



# Missile laser track display

Score Keeper - AWSS\_TEST - 3-101T7DA - [Eng #2, Missile Target: V 31]

File RTP Edit Summary Window Help

File Edit View Options Database Help

File #  Pilot

Engagement  of 9 CPG

AC#  AH-64D

Status

<< Scenario Print Summary

Wpn	Type	Bat Pos	Target	Hits	Kill
M	LOBL	FP 2	V 31	1	X

Target  Date/Time

Bat Pos  Target Up  Down

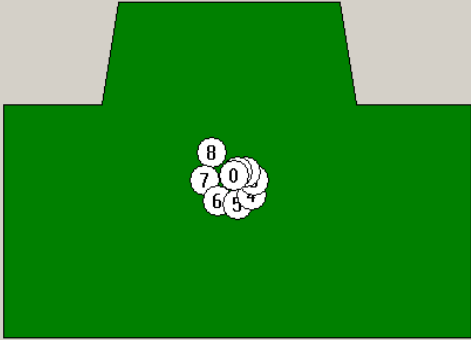
Range  meter Laser Code

TOF  sec

Mode  >>> Hit <<< 14.1 sec

Remark

Laser Track Timeline



Ready NUM

# Missile timeline display

Score Keeper - AWSS\_TEST - 3-101T7DA - [Eng #2, Missile Target: V 31]

File RTP Edit Summary Window Help

File Edit View Options Database Help

File # **00018** Pilot **SMITH**

Engagement **2** of **9** CPG **KRAUSE**

AC# **123** AH-64D

Status

<< Scenario Print Summary

Wpn	Type	Bat Pos	Target	Hits	Kill
M	LOBL	FP 2	V 31	1	X

Target **V 31** Date/Time **22-Jul-2004 13:34:03**

Bat Pos **FP 2** Target Up **13:34:05** Down **13:34:19**

Range **3162** meter Laser Code **1111**

TOF **11** sec

Mode **LOBL** >>> Hit <<< **14.1 sec**

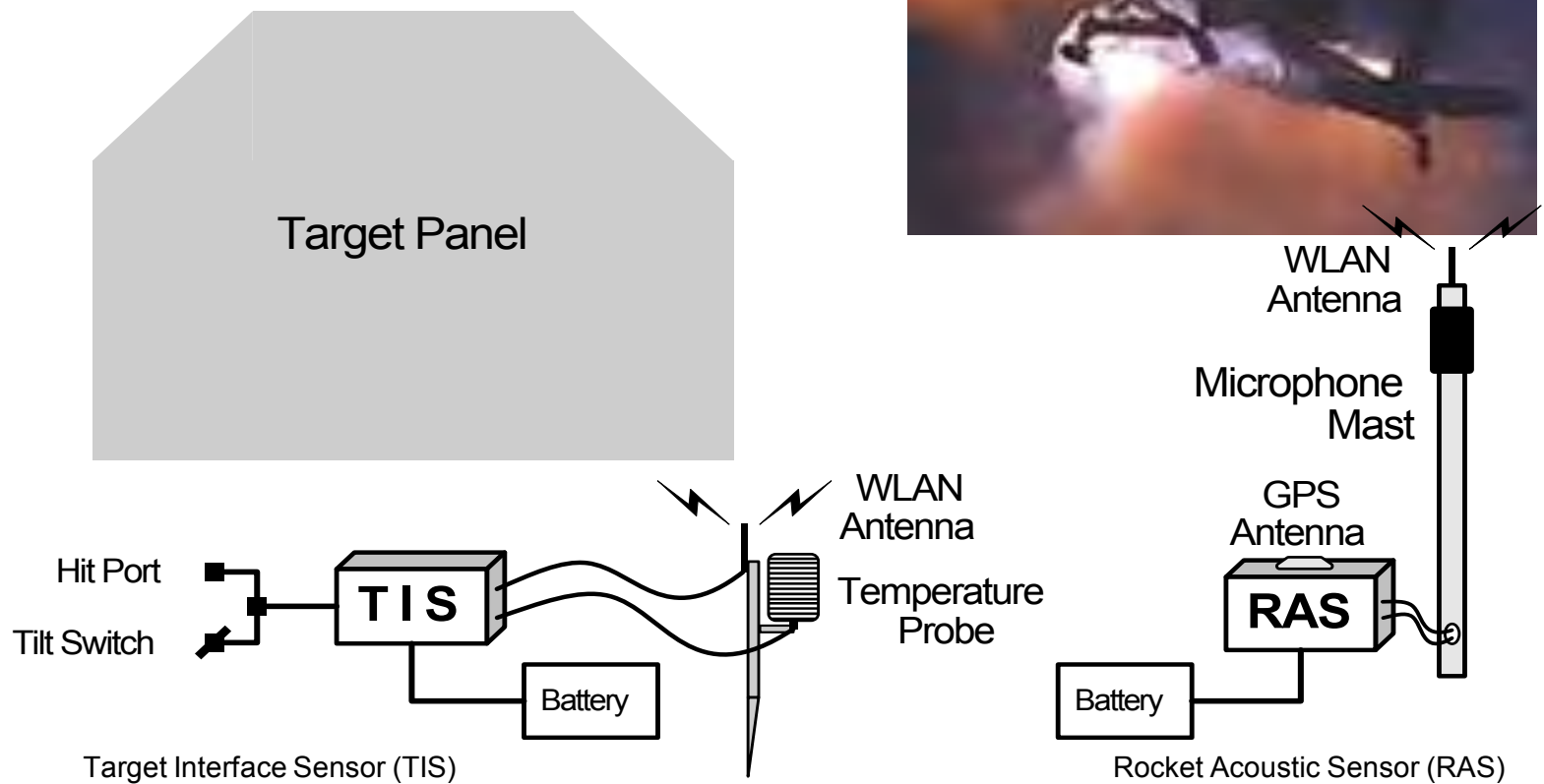
Remark  
Laser energy on target during offset period.

Laser Track Timeline

Secs	Event Log	Time	Count	Laser Status
	Target Up	13:34:05		
2.0	Pre-Launch	13:34:06		Offset
3.0	Missile Launch	13:34:08	11	Offset
		13:34:09	10	Offset
		13:34:10	9	Offset
		13:34:11	8	Offset -> On Tgt
7.2	Max On Target	13:34:12	7	On Target
6.0	Min On Target	13:34:13	6	On Target
		13:34:14	5	On Target
		13:34:15	4	On Target
		13:34:16	3	On Target
		13:34:17	2	On Target
		13:34:18	1	On Target
14.1	>>> Hit <<<	13:34:19	0	On Target

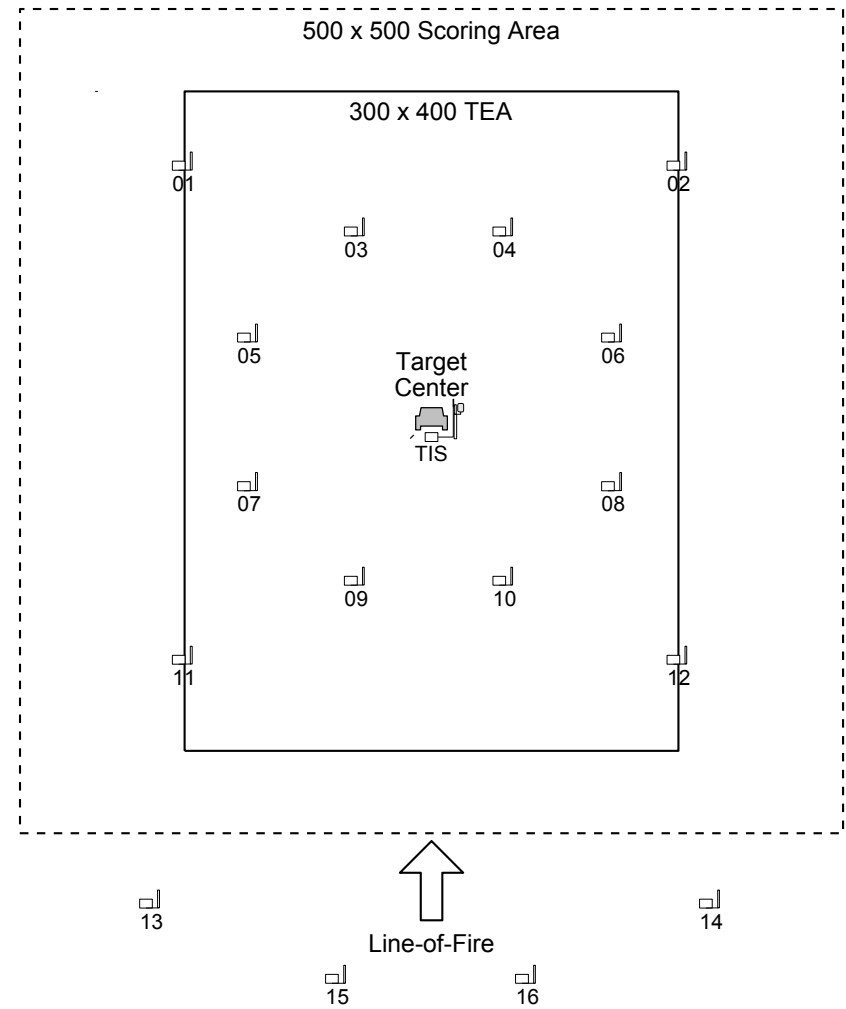
Ready NUM

# Rocket scoring subsystem



# Rocket scoring area

- » Impacts are accurately located within 500m X 500m zone.
- » Impacts within user defined Target Effect Area (TEA) area are indicated as target hits.
- » All impacts detected and resolved are indicated on score sheet for each target.



# Rocket scoring display

Score Keeper - AWSS\_TEST - 3-101T7DH - [Eng #3, Rocket Target: TGT A]

File RTP Edit Summary Window Help

File Edit RTP Summary Window Help

File #  Pilot

Engagement  of 9 CPG

AC #  AH-64D

Status

<< Scenario Print Summary

Wpn	Type	Bat Pos	Target	Hits	Kill
R	PD	FP 2	TGT A	4	X

Target  Date/Time

Bat Pos  Target Up  Down

Range  meter

TOF  sec

Rocket

Hits To Kill  29 C

# In TEA  Dets

>>> Kill <<< 42.0 sec

#	Det Time	Hit	X	Y
1	11:34:29.0	X	112	-181
2	11:34:38.0		-51	-241
	11:34:38.0		-200	-161
3	11:34:47.0	X	-100	-91
	11:34:47.0		-179	71
4	11:34:56.0		44	237
	11:34:56.0		151	261
5	11:35:05.0	X	98	-24
	11:35:05.0	X	20	119

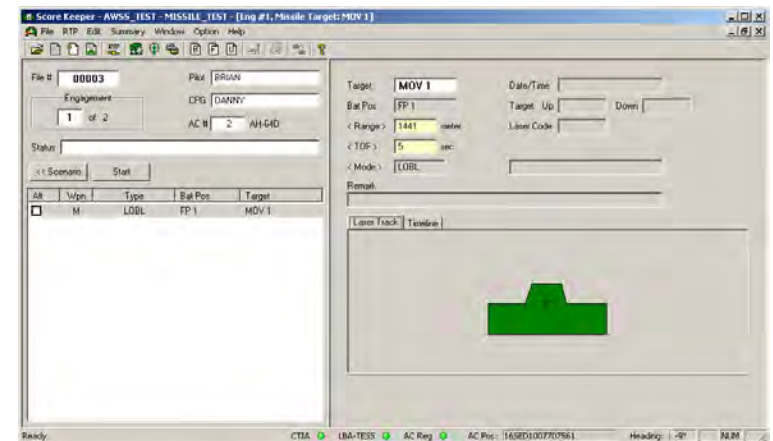
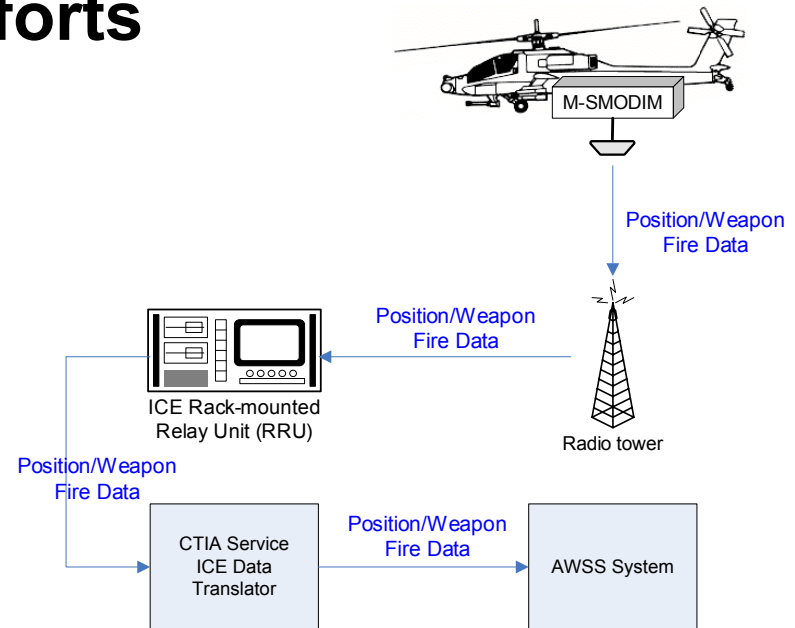
TEA 300 x 400

Ready NUM

# Current system upgrade efforts

## Aviation data capture

- » Integration of AWSS Control Station Subsystem with Aviation Tactical Engagement Simulation System (TESS)
  - Pulls A/C status & weapons data from the 1553 bus into the AWSS Control Station for improved scoring via the TESS, Smart Onboard Data Interface Module (SMODIM)
  - Automates the scoring process for the Hellfire Missile Engagements (using the Captive Training Missile) & eliminates the need for Pilot shot call
  - Provides a common GPS time base to sync the A/C weapon firing events to the AWSS score reporting





# Current system upgrade efforts cont.

## Unit gunnery summary report

- » Modified the AWSS CSS S/W to add a new database that allows for USAACE Gunnery Branch to perform unit level and Army-wide rollup to justify ammunition levels and track unit readiness

Sample Graphic Roll Up (Battalion)

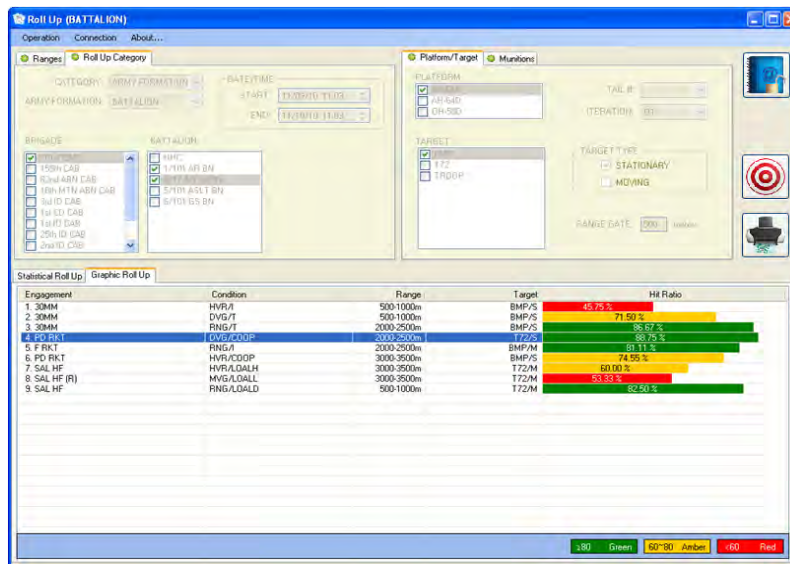
Engagement	Condition	Range	Target	Hit Ratio
1. 30MM	HVR / IHADSS	600	TROOP / S	80%
2. PD RKT	DVG / COOP	2000	BMP / S	80%
3. SAL HF	HVR / LOALH	4900	T72 / S	79%
4. SAL HF	RNG / LOALD	4000	T72 / M	90%
5. 30MM	RNG / TADS	1200	TECH / S	88%
6. SAL HF (R)	HVR / LOALH	2300	T72 / S	96%
7. 30MM	DVG / TADS	1300	BMP / M	88%
8. F RKT	RNG / IHADSS	1200	BMP / M	70%
9. PD RKT	HVR / COOP	3200	TRUCK / S	48%
10. 30MM	DVG / IHADSS	800	TECH / S	83%
11. PD RKT	RNG / IHADSS	2000	TROOP / S	90%
12. SAL HF	HVR / LOALD	2300	T72	93%

> 80% - Green  
60-80% - Amber  
< 60% - Red

Roll Up (Table 7DN and 8DN / Engagement 1 - 30MM IHADSS)

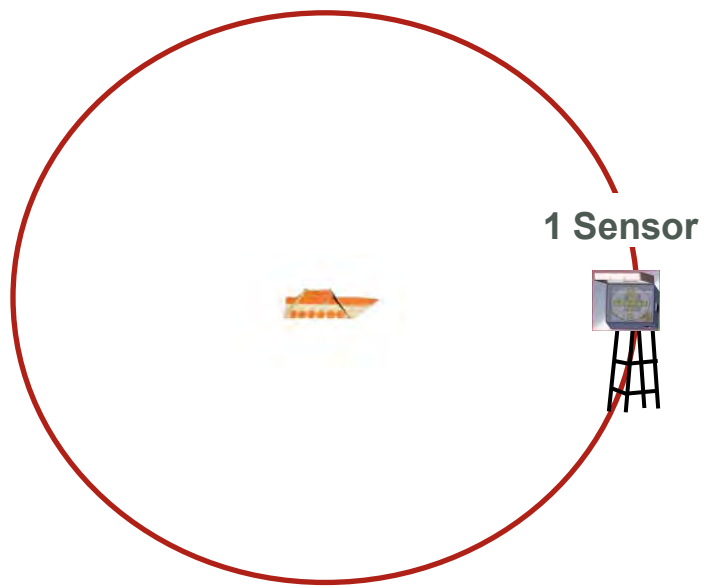


Bullet Size	Battle Position	Target Mnemonic	Total Hits	Total Rounds
30MM	FP1A	A-7	1601	2040

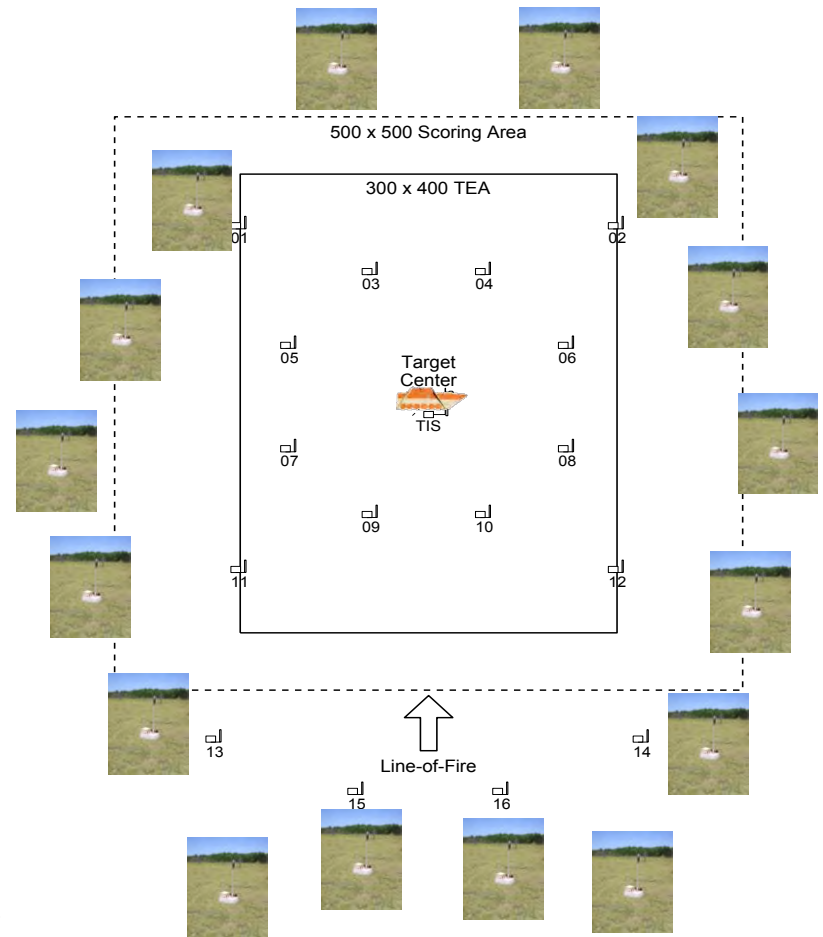


# Current system upgrade efforts cont.

## Radar vs. Acoustic Rocket Scoring



Enables diving fire:  
Rapid rocket scoring  
Paired rocket scoring

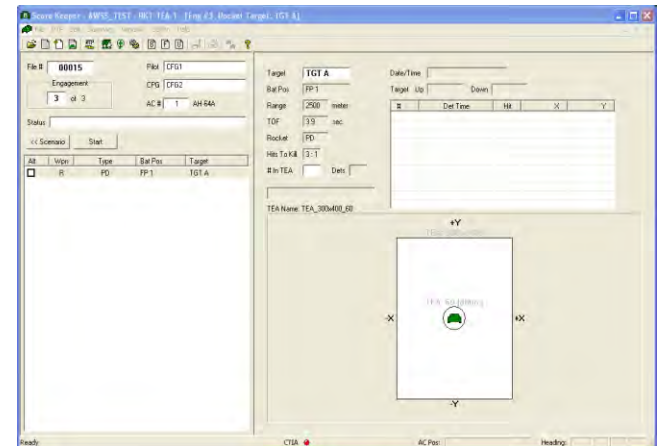


# Current system upgrade efforts cont.

## Radar rocket scoring

### » Evaluation of Radar for Short range, Rapid Fire Rocket Scoring

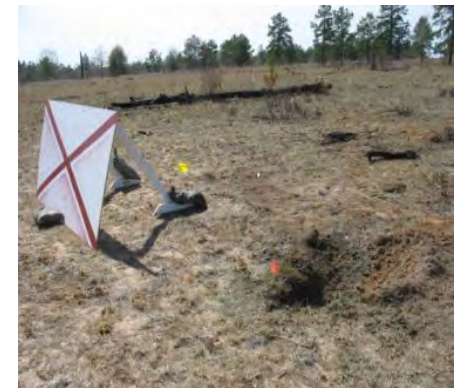
- NAWC/WD Targets System Division, Point Mugu/Port Hueneme entered a loan agreement with the US Army (PM ITTS, TMO) to conduct evaluations of the Surface Target Vector Scorer (STVS) for data collection and proof of concept
  - NAWC/WD Targets System Division
  - POC: Mr. Dae Hong 805-989-5996  
[dae.hong@navy.mil](mailto:dae.hong@navy.mil)
- STVS was recently developed for the US Navy for enhanced fleet training capabilities during gun weapon system & missile firing
- Goal was to enable the AWSS to provide accurate scoring of single, pairs & ripple fire M274 Point Detonation 2.75" Training Rockets when fired at range to target of less than 1500 meters



# Current system upgrade efforts cont.

## Radar rocket scoring

- » Evaluation of Radar for Short range, Rapid Fire Rocket Scoring
- » Work performed
  - MDSI received the transfer of STVS hardware from USN (NAWC/WD Targets System Division)
  - Prototype Antenna design was completed
  - Initial algorithms were refined and all hardware was tested
  - Successful live-fire data collection was carried out 4-16 March 2010
  - Processed all data for shots within the designated TEA (100 Meter Circle)

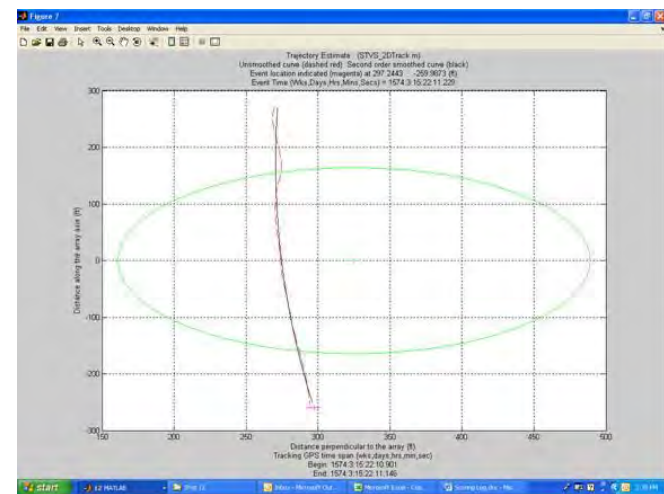
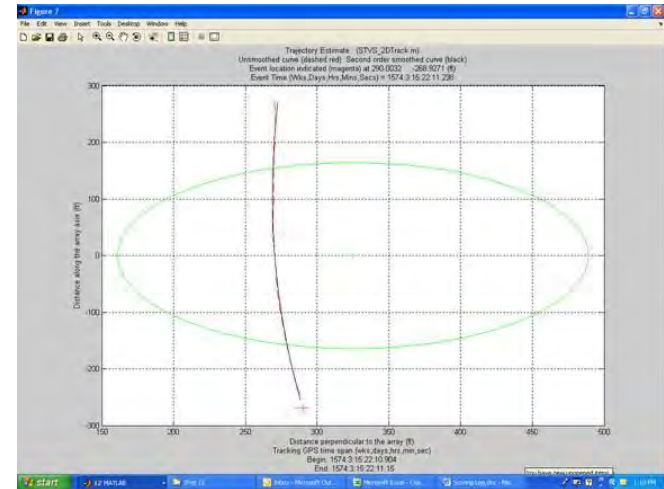
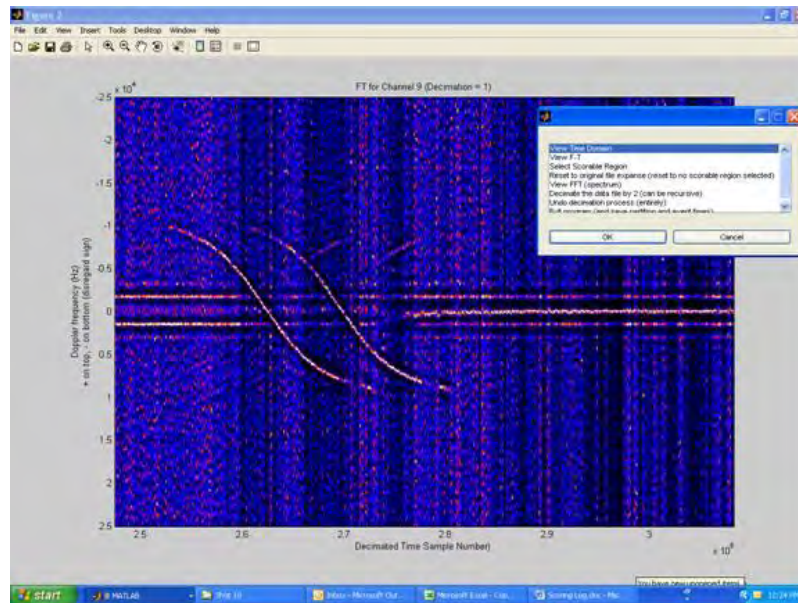




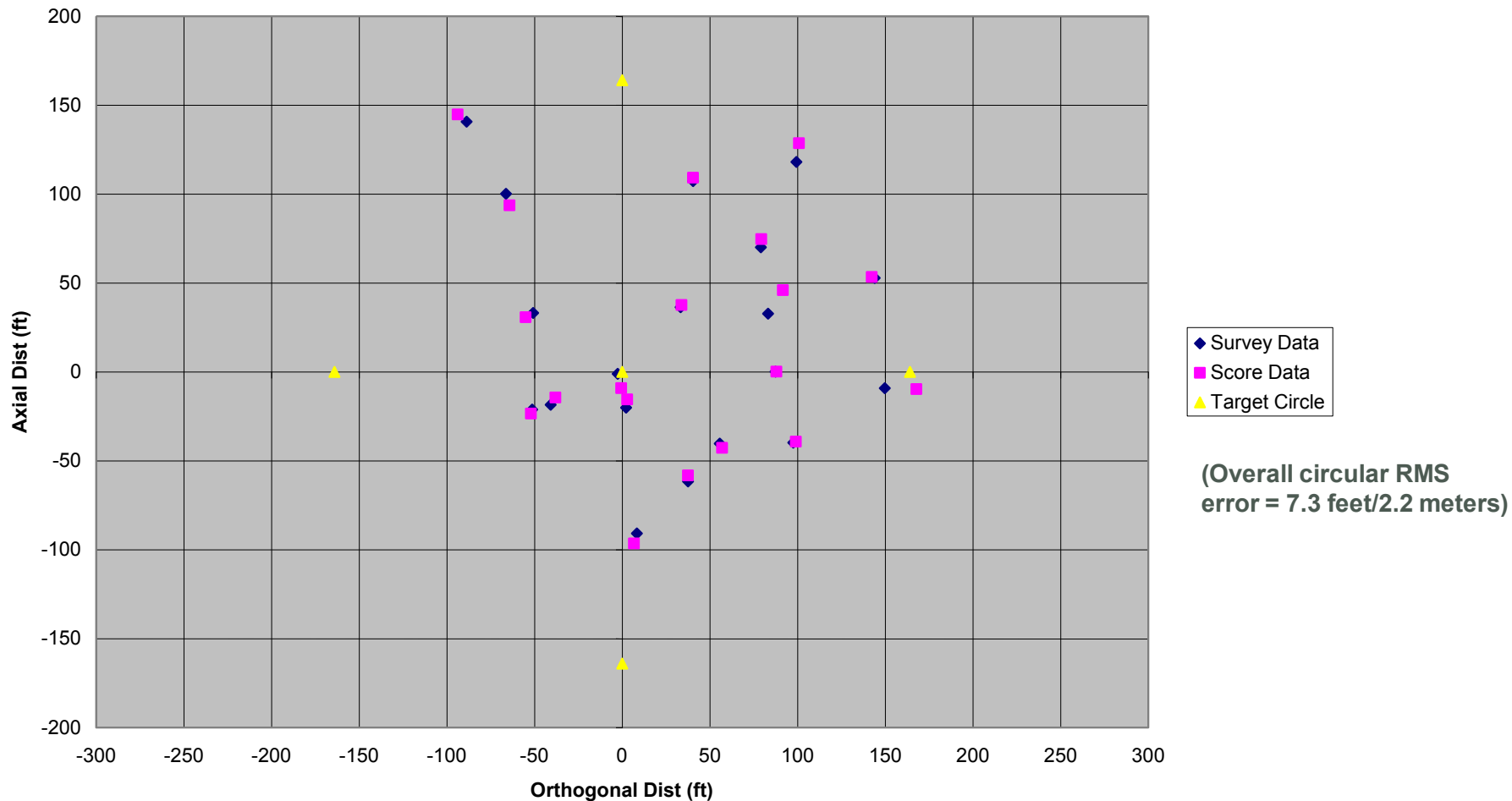
# Current system upgrade efforts cont.

## Radar rocket scoring

- » Data shows two individual rockets fired as a pair in a color frequency vs. time display
- » Each rocket was tracked separately to process the impact points

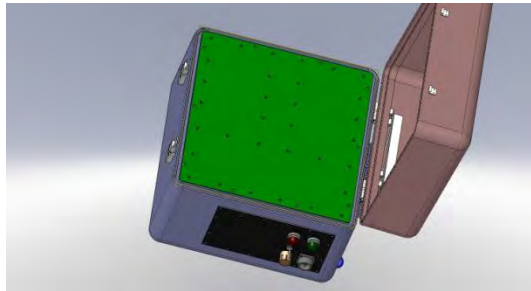


# Summary of rocket impacts vs. processed Radar Rocket Scoring Using STVS



Aerial Weapon Scoring System NDIA 49th Annual Targets, UAVs and Range Operations Symposium

# Conceptual radar design



Mounting Pole  
& Base Pole



Adjustable Tripod Legs  
for Uneven Terrain



Aluminum Base Plates



Free Spinning Guy Ring  
for Directional Control



Tripod with Compass  
and Bubble Levels



Interlocking Mast Sections



# Government & service contractor POC's

---

## » Training Requirements/Doctrine:

- CW5 Robert S. Jackson – USAACE, Gunnery Branch, Ft. Rucker
  - 334-255-2691, Robert.S.Jackson2@us.army.mil
- Mr. Ron Moring – Army Aviation Training Specialist - ATSC, TCM-Live, LTD  
757-878-2320, ron.moring@us.army.mil

## » Engineering/Development/Production:

- Mr. Barry Hatchett – AWSS PD, PEO-STRI, PM-ITTS, Targets Management Office
  - 256-842-6797, barry.hatchett@us.army.mil

## » Operations:

- Mr. Todd Pesicek, PEO STRI, PM Field Ops  
407-384-5524, Todd.Pesicek@us.army.mil
- Mr. Troy Stevens – AWSS Operations Manager – Warrior Training Alliance, CSC  
254-702-3400, Troy\_L\_Stevens@raytheon.com

# Questions / comments ?

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**Derek Foster**  
**Program Director, Electronic Systems**  
**Meggitt Defense Systems Inc.**  
**(949) 465-7700 ext 2041**  
**derek.foster@meggitt.com**



**Thank you**





# Spectrum Processes: What does it take to Radiate?

Mr. Joe P. Giangrosso  
RF Spectrum Engineer  
Office of the DoD Gulf Area Frequency Coordinator  
96 CS/SCXF  
Eglin AFB, FL 32542  
850-882-4416



# Briefing Outline

- Introduction
- Spectrum Certification Process
- Frequency Assignment Process
- Office Contact Information
- Presidential Broadband Plan
- Conclusion



# INTRODUCTION

- **Access to RF Spectrum Is Increasingly Critical to the AF Mission:**
  - Needs Are Increasing –
  - Access Threatened by Commercial/International Competing Interests - Threat to Info Superiority Getting Worse
- **High Value Spectrum Is Often Over-Allocated - Military Uses Are Often Lower Priority, esp. Outside US**
- **Spectrum Management Is a Complex, Highly Political Process:**
  - Policy and processes governed by Federal Law and DoD Regulations
    - Federal Agency oversight by the National Telecommunications Information Administration (NTIA) as per CFR Title 47
  - Complex National/International Organizational Structures Affect AF's Ability to Influence Spectrum Decisions & Defend Interests
- **Current Situation Is Heavily Biased In Favor of Commercial Interests:**
  - National/International Spectrum Management Organizational Structure
  - Lack of Understanding of National Security Aspects of Spectrum Allocation In Congress & Most Agencies
  - Huge money maker



# What is Spectrum Management

**“Planning, coordinating, and managing joint use of the electromagnetic spectrum through operational, engineering, and administrative procedures, with the objective of enabling electronic systems to perform their functions in the intended environment without causing or suffering unacceptable interference.”**





# DoD Operational Challenge





# Spectrum Certification Process



# Allocation vs. Assignment

- **Allocation (Equipment certification)**
  - **Builder's permit**
  - **Design Data (DD FM 1494)**
    - **Engineering focus**
  - **Customer = Mostly AQ**
  - **Interfere with another community? (broad view)**
  - **Emanation fits US/Host Nation use rules?**
  - **Can drive redesign**
  - **Outcome is MCEB directed operating restraints**



- **Assignment (Specific use)**
  - License to Radiate
  - Operating Data (Standard Frequency Action Format)
    - Location and Time focus
  - Customer = Warfighter
  - Interfere with neighbor?
  - Receive interference from others?
  - Adhere to Military Communications-Electronics Board (MCEB) operating restraints



# **Spectrum Certification Process**

## **Spectrum Planning Subgroup Review**

- **All systems used by DoD in the US require NTIA certification and USMCEB review .**
- **NTIA review/approval is through the Spectrum Planning Subgroup (SPS)**
- **Other than the systems listed below, the AFSMO determines which DD Forms 1494 require SPS review.**
  - **New systems or subsystems and major modifications to existing systems involving use of satellites or spacecraft.**
  - **All new systems or subsystems and major modifications to existing systems previously reviewed by the SPS if there is a significant impact on the RF spectrum when considering geographical location and frequency availability.**
  - **Land mobile radio (LMR) trunked systems.**
  - **Other systems or facilities that the NTIA, Interdepartmental Radio Advisory Committee (IRAC), or other government agencies refer to the SPS.**





# **Spectrum Certification Process**

- **DoD assigned the responsibility for military frequency engineering and management to the US Military Communications-Electronics Board (USMCEB). To obtain authority to Radiate, there are two processes:**
  - **DD Form 1494, Application for Equipment Frequency Allocation-certification of spectrum support**
  - **the frequency assignment proposal or request-operator's license.**
- **The USMCEB, through the SPS, reviews the characteristics of C-E equipment purchased or developed by the DoD.**
- **Joint Frequency Equipment Allocation Process (also called the J/F-12 Process)**
  - **defined by requirements established by NTIA/SPS, and military joint or allied system review groups.**



# Getting The Spectrum Support Process Started

- RF transmitting or receiving device design must be presented on a DD Form 1494 as early as possible in the acquisition (or modification) process. This is required regardless of power output.
- Inclusion of DFAR clause 252.235-7003 in contracts involving these (RF) devices is recommended.
- Including the DD Form 1494 in the CDRL for Stage 3 and Stage 4 is a requirement. This reflects the contractor's developmental and production equipment.
- Completed DD Form 1494 should be submitted to the Program Office (PO) designated as the lead agent for the program.



# Spectrum Certification Stage Definition

- **DD Form 1494-Stage Definition**
  - **Stage 1 Conceptual:** Usually for Lab concepts and development. Completed prior to possible obligation of Government funds.
  - **Stage 2 Experimental:** Usually for all PO's and approval is required prior to Government obligation of funds. The Form is completed by the PO and reflects the specified technical parameters as calculated by the engineering staff.





# Spectrum Certification

## Stage Definition

- **DD Form 1494-Stage Definition (cont)**
  - **Stage 3 Development:** At this stage the contractor is responsible for completing the form. The program should have just completed its final technical review. This stage provides the contractor's position for the device and once approved, would allow the contractor to perform open air testing prior to a production decision. The approval of this stage will allow frequency assignments for test purposes only.
  - **Stage 4 Operational:** At this stage, the contractor is responsible for completing the form. The data provided **shall** be measured from one of the first production or LRIP units. With approval of this stage, operational frequency assignments are requested for the operating locations with the exception of OCONUS locations.



CLASSIFICATION

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PAGE 2

## TRANSMITTER EQUIPMENT CHARACTERISTICS

<b>1. NOMENCLATURE, MANUFACTURER'S MODEL NO</b> (U) TN-X/30		<b>2. MANUFACTURER'S NAME</b> (U) Northern Radio and Wireless	
<b>3. TRANSMITTER INSTALLATION</b> (U) Fixed		<b>4. TRANSMITTER TYPE</b> (U) QAM Communications	
<b>5. TUNING RANGE</b> (U) 7442 MHz - 7883 MHz		<b>6. METHOD OF TUNING</b> (U) Synthesizer	
<b>7. RF CHANNELING CAPABILITY</b> (U) 7442 MHz, 28 MHz increments		<b>8. EMISSION DESIGNATORS</b> (U) 28M0D7W (U) (U)	
<b>9. FREQUENCY TOLERANCE</b> (U) 10 ppm		<b>12. EMISSION BANDWIDTH</b> <input type="checkbox"/> CALCULATED <input checked="" type="checkbox"/> MEASURED	
<b>10. FILTER EMPLOYED</b> (U) <input checked="" type="checkbox"/> a. YES <input type="checkbox"/> b. NO		a. -3 dB (U) 22 MHz (U) (U)	
<b>11. SPREAD SPECTRUM</b> (U) <input type="checkbox"/> a. YES <input checked="" type="checkbox"/> b. NO		b. -20 dB (U) 26 MHz (U) (U)	
<b>13. MAXIMUM BIT RATE</b> (U) 171.7 Mbps		c. -40 dB (U) 36 MHz (U) (U)	
<b>14. MODULATION TECHNIQUES AND CODING</b> (U) 128 QAM; FEC		d. -60 dB (U) 44 MHz (U) (U)	
<b>16. PRE-EMPHASIS</b> (U) <input type="checkbox"/> a. YES <input checked="" type="checkbox"/> b. NO		e. OC-BW (U) 28 MHz (U) (U)	
<b>19. POWER</b>		<b>15. MAXIMUM MODULATION FREQUENCY</b> (U) NA	
a. MEAN (U) 1.4 mW (U) (U) - 1.35 W		<b>17. DEVIATION RATIO</b> (U) NA	
b. PEP (U) NA (U) (U)		<b>18. PULSE CHARACTERISTICS</b>	
<b>20. OUTPUT DEVICE</b> (U) Solid state		a. RATE (U) NA (U) (U)	
<b>22. SPURIOUS LEVEL</b> (U) -109 dB		b. WIDTH (U) NA (U) (U)	
<b>23. FCC TYPE ACCEPTANCE NO.</b> (U) CXP7UJ8X30A1		c. RISE TIME (U) NA (U) (U)	
<b>24. REMARKS</b> (U) Item 10: 6-pole waveguide filter.		d. FALL TIME (U) NA (U) (U)	
		e. COMP RATIO (U) NA (U) (U)	
		<b>21. HARMONIC LEVEL</b>	
		a. 2nd (U) -45 dB	
		b. 3rd (U) -45 dB	
		c. OTHER (U) -45 dB	

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J/F 12/09120



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## RECEIVER EQUIPMENT CHARACTERISTICS

<b>1. NOMENCLATURE, MANUFACTURER'S MODEL NO.</b> (U) TN-X/30				<b>2. MANUFACTURER'S NAME</b> (U) Northern Radio and Wireless	
<b>3. RECEIVER INSTALLATION</b> (U) Fixed				<b>4. RECEIVER TYPE</b> (U) Singel Conversion Superheterodyne	
<b>5. TUNING RANGE</b> (U) 7442 MHz - 7883 MHz				<b>6. METHOD OF TUNING</b> (U) Synthesizer	
<b>7. RF CHANNELING CAPABILITY</b> (U) 7442 MHz, 28 MHz incr.				<b>8. EMISSION DESIGNATORS</b> (U) 28M0D7W	
<b>9. FREQUENCY TOLERANCE</b> (U) 10 ppm				<b>11. RF SELECTIVITY</b> <input type="checkbox"/> CALCULATED <input checked="" type="checkbox"/> MEASURED	
<b>10. IF SELECTIVITY</b>	<b>1st (U)</b>	<b>2nd (U)</b>	<b>3rd (U)</b>	<b>a. -3 dB</b> (U) 52 MHz	
a. -3 dB	32 MHz	NA	NA	<b>b. -20 dB</b> (U) 70 MHz	
b. -20 dB	52 MHz	NA	NA	<b>c. -60 dB</b> (U) 140 MHz	
c. -60 dB	64 MHz	NA	NA	<b>d. Preselection Type</b> (U) SAW/Waveguide	
<b>12. IF FREQUENCY</b> 140 MHz				<b>13. MAXIMUM POST DETECTION FREQUENCY</b> (U) NA	
NA				<b>14. MINIMUM POST DETECTION FREQUENCY</b> (U) NA	
<b>15. OSCILLATOR TUNED</b>				<b>16. MAXIMUM BIT RATE</b> (U) 171.7 Mbps	
	<b>1st (U)</b>	<b>2nd (U)</b>	<b>3rd (U)</b>	<b>17. SENSITIVITY</b>	
a. ABOVE TUNED FREQUENCY				<b>a. SENSITIVITY</b> (U) - 68 dBm	
b. BELOW TUNED FREQUENCY				<b>b. CRITERIA</b> (U) BER=10x-6	
c. EITHER ABOVE OR BELOW THE FREQUENCY	X			<b>c. NOISE FIG</b> (U) 2.9 dB	
<b>18. DE-EMPHASIS</b> (U) <input type="checkbox"/> a. YES <input checked="" type="checkbox"/> b. NO				<b>d. NOISE TEMP</b> (U) NA	
<b>19. IMAGE REJECTION</b> (U) 120 dB				<b>20. SPURIOUS REJECTION</b> (U) 130 dB	
<b>21. REMARKS (U)</b>					

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J/F 12/09120

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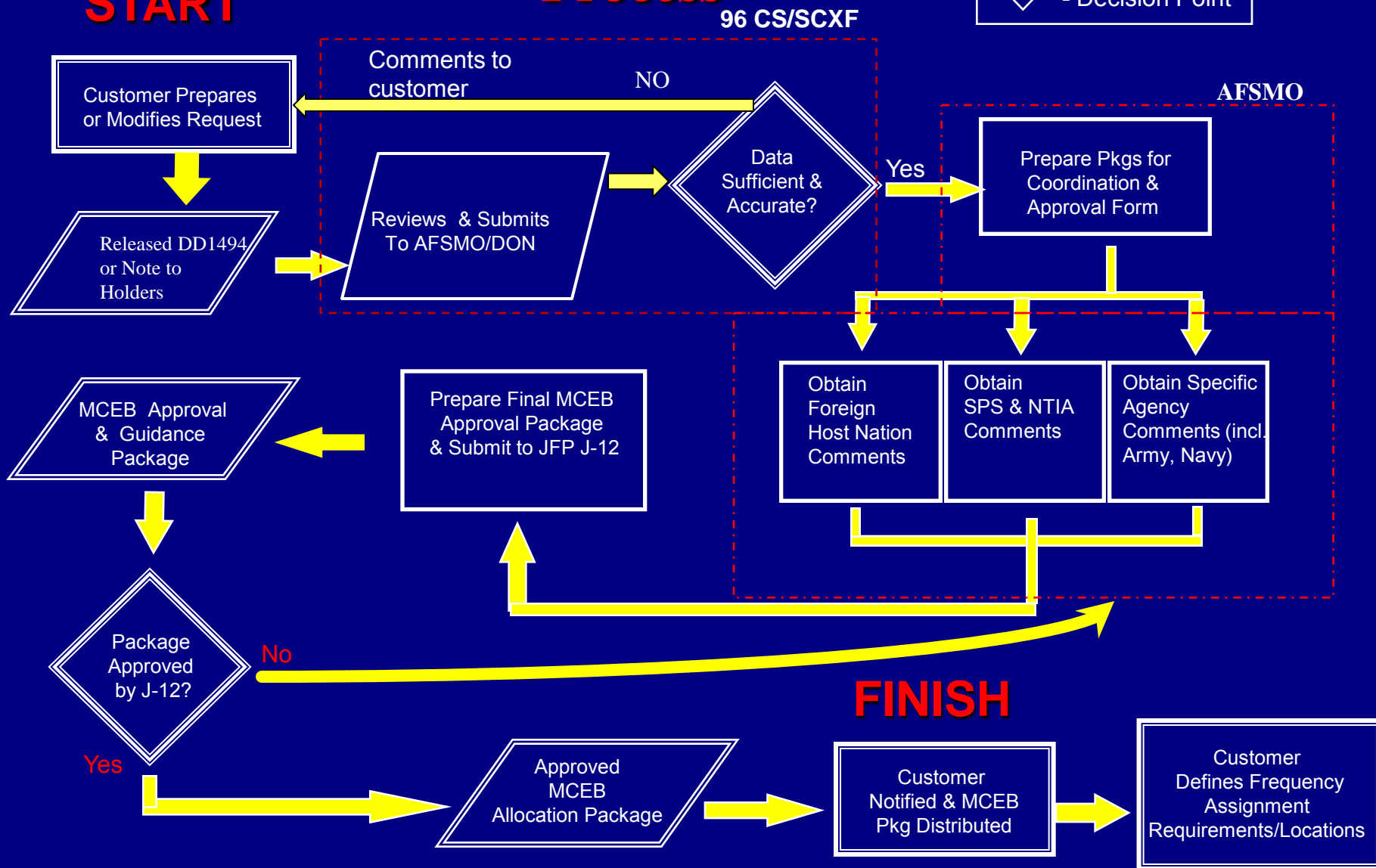




# AF Equipment Certification Process

- - Process
- ▱ - Output
- ◇ - Decision Point

**START**





# PROBLEM AREA ACQUISITION REFORM

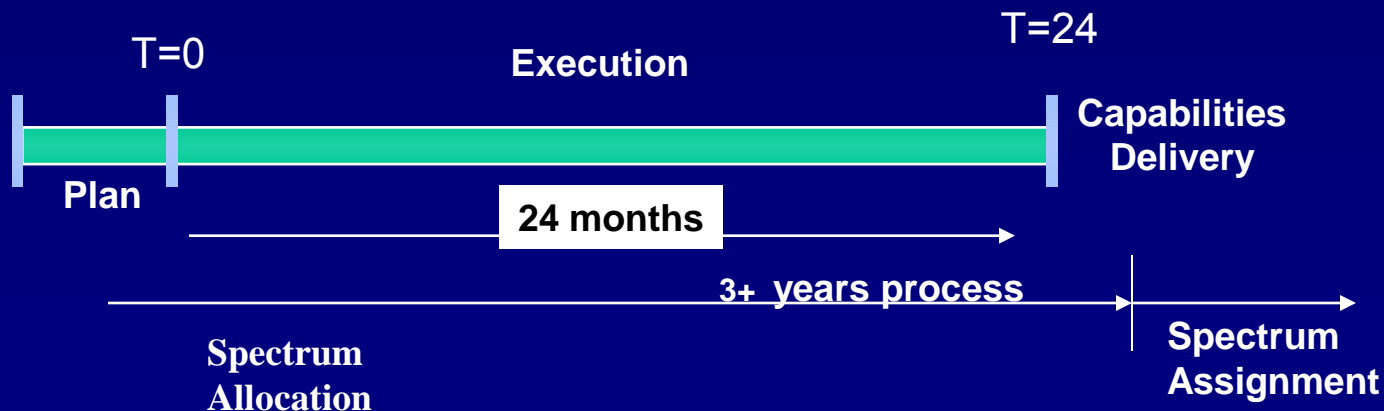


## FAST TRACK PROCUREMENT

*puts*

## FREQUENCY APPROVAL

on  
*Critical path*





# **Spectrum Certification Process**

## **Note to Holder**

- **Use the MCEB Note-to-Holder for amendments and updates to approved DD Forms 1494 (J/F-12) documents and MCEB memoranda.**
- **Note-to-Holder requests are sent through 96 CS/SCXF to the AFSMO and follow same process as DD Form 1494.**
- **Distribute host nation comments to applications by a Note-to-Holder. A Note-to-Holder to distribute host nation and CINC comments received about an application is created by the AFSMO, approved by the MCEB J-12 Permanent Working Groups, and distributed to the MCEB J-12 distribution list.**





# **FREQUENCY ASSIGNMENT PROCESS**



# Allocation vs. **Assignment**

- Allocation (Equipment exam)
  - Builders permit
  - Design Data (DD FM 1494)
    - Engineering focus
  - Customer = Mostly AQ
  - Interfere with another community? (broad view)
  - Emanation fits US/Host Nation use rules?
  - Can drive redesign
  - Outcome is MCEB directed operating restraints
- **Assignment (Specific use)**
  - **License to Radiate**
  - **Operating Data (Standard Frequency Action Format)**
    - **Location and Time focus**
  - **Customer = Warfighter**
  - **Interfere with neighbor?**
  - **Receive interference from others?**
  - Adhere to Military Communications-Electronics Board (MCEB) operating restraints



# FREQUENCY ASSIGNMENT PROCESS

- Before making a frequency assignment, the USMCEB must review the RF equipment via an approved DD Form 1494 (J/F 12)
- For all equipment developed at Eglin, the Eglin Installation Spectrum Manager (ISM) is required to request assignments for ALL LOCATIONS in which that equipment is planned to operate.
- The Installation Commander, through the ISM, can prohibit use of ANY RF emitter (cease and desist) when anticipating interference to mission essential electromagnetic equipment.
- All RF emitters must have a frequency assignment prior to operation. DoD GAFC has inherent authority from NTIA to make assignments as deemed necessary to meet mission requirements. A DD Form 1494 must have been submitted before this is valid.



# Frequency Coordination

- The DoD does not own any spectrum exclusively for military use. In fact, spectrum is not owned by any organization,
- It is “allocated” or managed by either the FCC (state, local, public and private users) or the NTIA (federal users). These two agencies manage all of the spectrum for the US.
  - Example: The DoD manages the spectrum between 225 MHz and 399.9 MHz for the federal government (NTIA) through the Military Assignment Group but is used by both DoD and FAA.
- When it is necessary for the Air Force to use frequencies managed by another federal department or agency, the Air Force must coordinate with the appropriate agency prior to submitting a frequency request to the NTIA for assignment action.



# AFSMO lead-times

- For US&P operations
  - **Permanent Assignments. Sixty days.**
  - **Experimental Assignments. Sixty days.**
  - **In most cases, additional lead-time is required for all actions requiring coordination with the FCC or the FAA.**
  - **Requirements not in accordance with the national table of allocations, or have unusual technical parameters, may require additional engineering time or study, consequently requiring even longer lead-times. It is not uncommon for such requests to take more than six months at the national level.**



# Contractor Use of Frequencies.

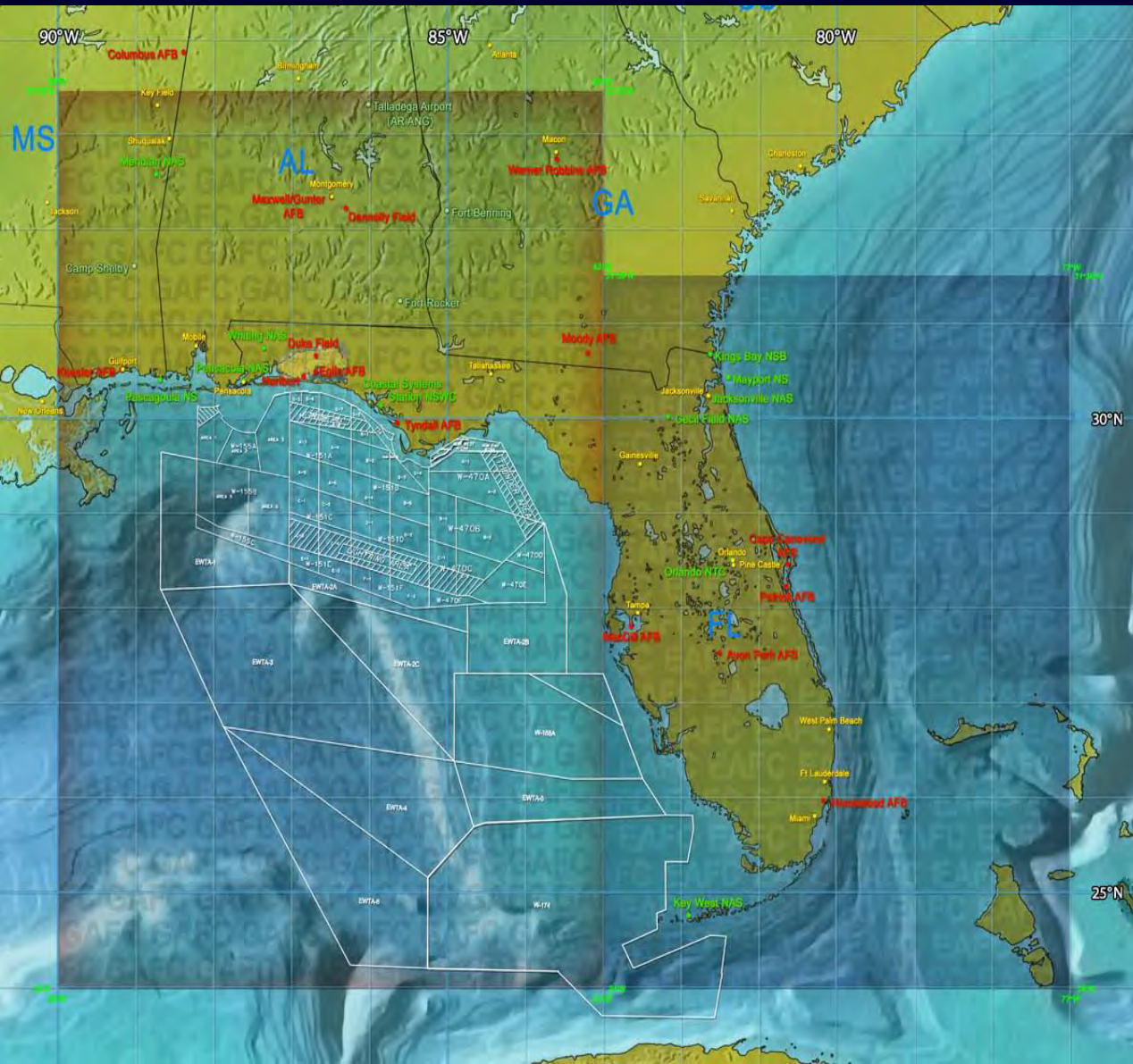


- **Air Force contracts.**
  - Contractors must submit frequency requests in direct support of Air Force contracts through the PO representative to the ISM.
  - The contractor must obtain frequency assignments from the FCC for requirements not in direct support of an AF contract. Example: Foreign direct sale of a military article.
- **Multiple service contracts.**
  - Contractors must submit frequency requests in support of a multiple service contract through the appropriate spectrum management channels to the military department that is the executive service for the contract.
  - The contractor must obtain frequency assignments from the FCC for requirements not in direct support of the contract.





# *DoD GAFC AOR/Contact Info*



**DoD GAFC  
AOR REPRESENTS  
313,200 SQ MILES**

**EGLIN LAND RANGE  
724 SQ MILES**

**TOTAL AIRSPACE  
AVAILABLE TO EGLIN  
INCLUDING MOAS  
APPROX. 134,000 SQ MILES**

## **Contact**

*DoD Gulf Area Frequency Coordinator*

96 CS/SCXF

201 W. Eglin Blvd., Ste. 256

Eglin Air Force Base, FL 32542-6829

Tel: 850-883-7535



# Presidential Wireless Broadband Plan

- Signed in June 2010
- Locate 500 MHz of spectrum for wireless broadband application: plan signed in Oct 2010
  - Study 11 Bands-both Federal and non-Federal allocations
- Vacate bands within 10 years
- First priority to vacate: 1755-1850 MHz TM band
  - May sell off 1755-1780 in first round – Vacate in 5 years
  - Second round to include 1780-1850 MHz – Vacate in 10 years
  - NTIA rule: no new system allowed in this band-status quo
  - UAVs cannot co-exist with other systems merging into compressed band: 1780-1850 MHz
  - UAV operations impacted CONUS wide: may require exclusion zones for continued operations



# Conclusion

- RF Spectrum is a scarce and finite “NATURAL RESOURCE” and a “Cash Cow”.
- Certifications and Assignments required before authority to “Radiate” can be granted.
- Used world wide: processes must be followed for interoperability amongst all users .
- Certifications and Assignments are required under the authority of NTIA Manual/CFR Title 47 as well as DoD and Service Acquisition Regulations
- Loss of spectrum will see movement into new bands
  - New technical challenge: relocate without capability losses



**QUESTIONS ?????**





# ***Common Range Integrated Instrumentation System (CRIIS)***

**National Defense Industrial Association**  
*49<sup>th</sup> Annual Targets, UAVs & Range Operations  
Symposium & Exhibition*



## **CRIIS Program Overview**

### **October 2011**

*Mr. Chris Hughes, CRIIS Program*  
Email: [christopher.hughes2@eglin.af.mil](mailto:christopher.hughes2@eglin.af.mil)

*Distribution Statement A: Approved for public release. Distribution unlimited.*



# ***Outline***



- **Background**
- **Strategy**
- **Accomplishments**
- **Summary**





# ***CRIIS***



- **Development Funded by OSD via Central Test & Eval Investment Program**
  - CTEIP Highest Priority Program
- **Production and Sustainment Funded by Each Service**
- **Advanced Tri-Service Range Instrumentation System**
  - Supports 5th Generation Fighters
  - Provides Sub-meter High Dynamic Tracking Accuracy with Secure Datalink
    - Top Secret & Multiple Independent Levels of Security Capable
- **50-Person Project Office**
- **\$500M Development and Production Value**
- **Prime Contractor: Rockwell Collins, Cedar Rapids, IA**

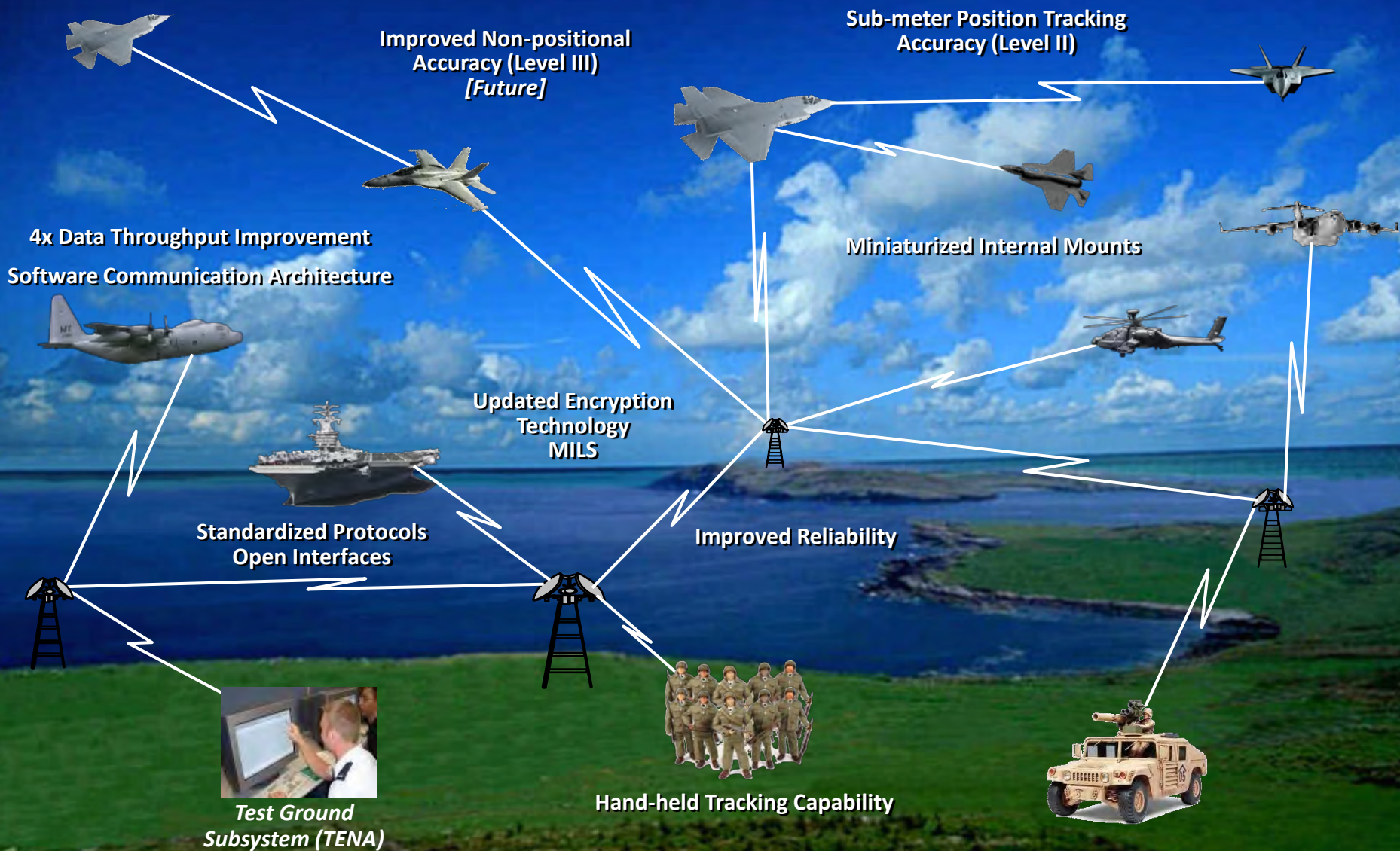


# ***Background***

- **Primary Function: Test Data Collection**
  - Land, Sea, and Airborne Platforms (Including F-22A and F-35)
  - Requires Equipment More Accurate than System Under Test (SUT)
- **CRIS Provides:**
  - High Accuracy Time, Space, Position Information (TSPI) of SUT
  - Secure Datalink(s) Transmit Real Time TSPI and Aircraft Data
    - Avionics
    - Weapons Targeting and Status Data
    - Aircraft Status
- **CRIS Maximizes Interoperability Among T&E Ranges**
- **Potential Use on Training Ranges**
- **CRIS Development Funded by Central Test & Evaluation Investment Program**
  - CRIS Production and Sustainment Funded by Individual Services

***CRIS is A Test Range Replacement of the Existing GPS Based ARDS  
With Advanced Datalink, TSPI, Security Features***

# CRIIS Overview



**Test Package Directive (TPD) Issued 7 Jul 10**





# Functional Configurations

## INCREMENT 1

### Configurations 1, 2, 3



*Config. 1  
Dismounted Soldier*

Level IB TSPI  
Mid Range DL  
Encryption



*Config. 2  
Low Dynamic Vehicles*



*Config. 3  
Ship-to-Shore*

Level IB TSPI  
Extended Range DL

## INCREMENT 2

### Configurations 4, 5, 6

Level II TSPI  
High Throughput DL  
Encryption



*Config. 4 Pod*



*Config. 5 Moderate Accuracy  
Multi-Package Internal Mount*



*Config. 6 Moderate Accuracy  
Single Package Internal Mount*

## INCREMENT 3

### Configurations 7, 8



*Config. 7 High Accuracy  
Multiple-Package Internal Mount*

Level III TSPI  
High Throughput DL  
Encryption



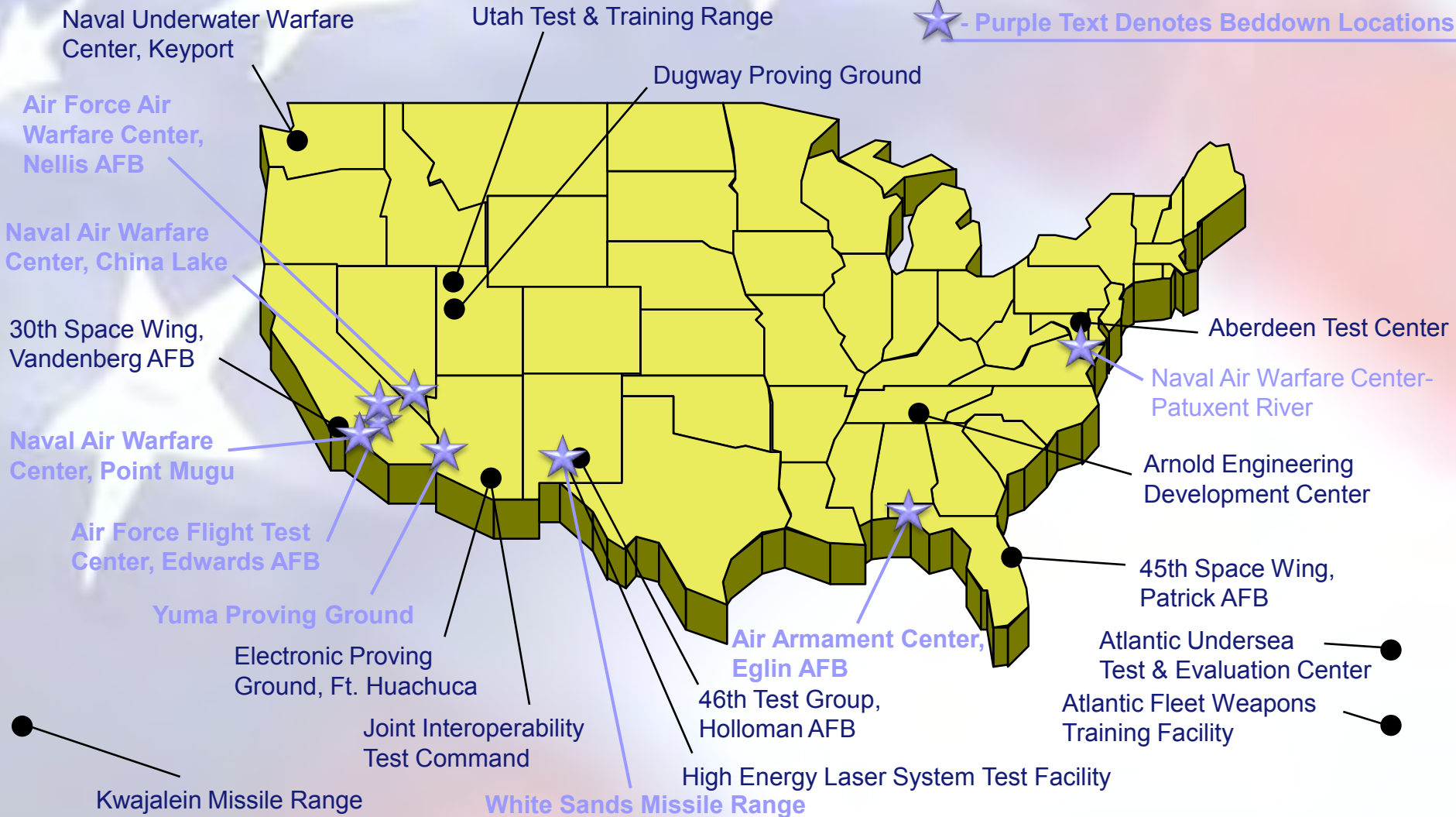
*Config. 8 High Accuracy  
Single Package Internal Mount*

**Ground Subsystem (GS)**



# Major Range and Test Facility Base (MRTFB) and Initial Beddown Locations

★ - Purple Text Denotes Beddown Locations





# ***Accomplishments/Status***

## ■ **Phase I Completed May 2010 – On Time and Within Budget**

- ✓ **Matured and Demonstrated TSPI Technology**
- ✓ **Reduced Risk, Demonstrated High Throughput Datalink**
- ✓ **Developed System Architecture and Preliminary Design, PDR**
- ✓ **Conducted Phase II Source Selection**
  - ✓ **Fixed Price Production Options in Hand**
  - ✓ **Sustainment Strategy in Place**

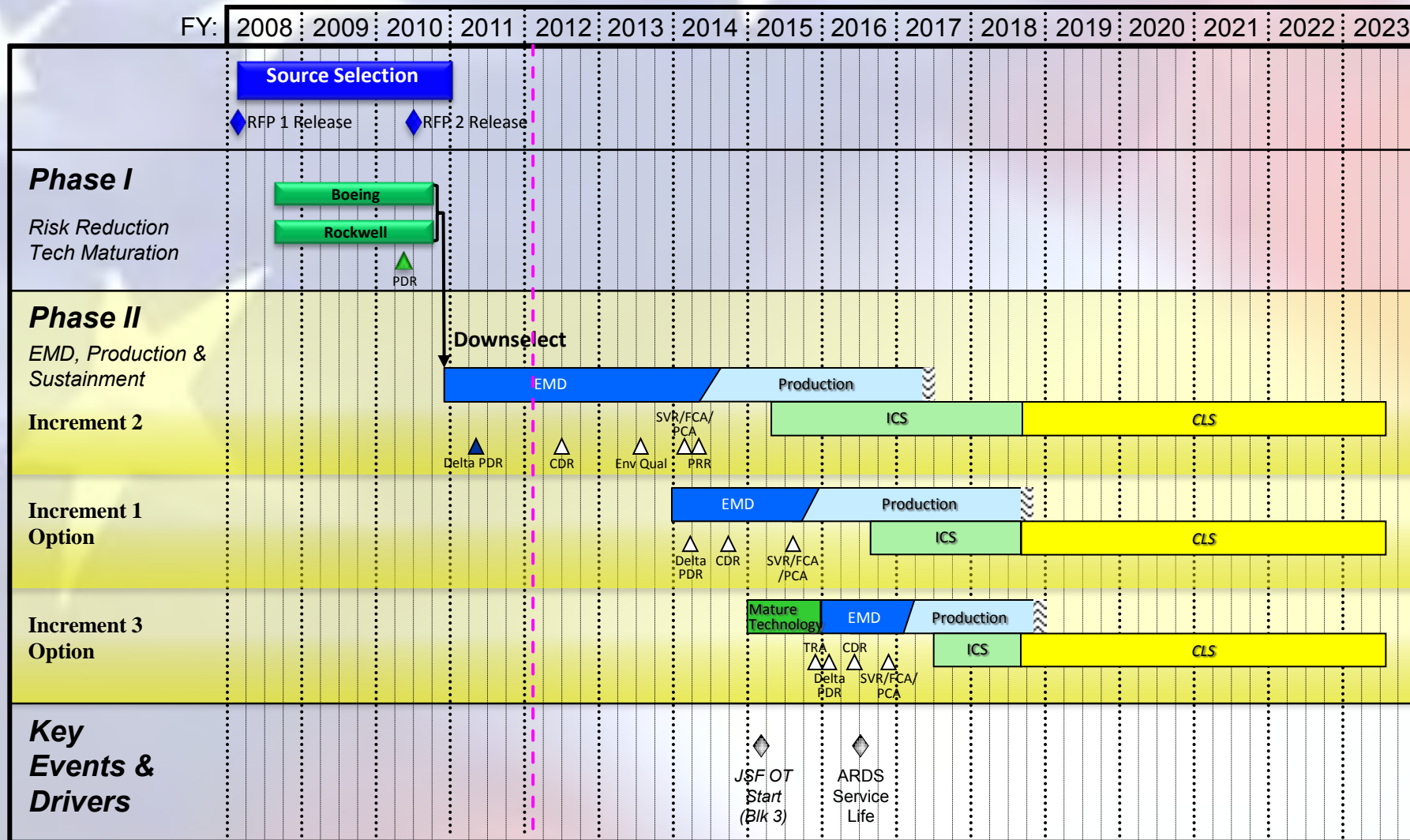
## ■ **Phase II EMD Activities Accomplished/Planned**

- ✓ **Completed Delta PDR 15-17 Feb 11**
- ✓ **Developed Prototype Boards**
- **Complete Detailed Design and Demonstration**
- **Perform Qualification Testing, Verification, and Validation**
- **Conduct Technical Reviews: CDR, TRR, PCA, FCA**
- **Develop Proof of Design/Manufacturing Units**
- **Transition to Production & Sustainment**





# CRIIS Program Schedule





# Sustainment Approach



Sustainment Activities	ICS	CLS
Depot Repair Facility (for All Assets that Cannot be Repaired at O-level)	✓	✓
On-Call Tech Support 24/7 Via Phone	✓	✓
On-Site Tech Support Visit (Once per Year per Range)	✓	
RAMPOD Data Maintenance for Depot Assets	✓	✓
Central Stocking Location	✓	✓
Spares Management	✓	✓
Ship Repaired Assets to Ranges	✓	✓
Demil and Disposal		✓
Performance-Based Logistics (Material Availability and Material Reliability)		✓



# ***Summary***

- **CRIIS is Funded and Executing Phase II**
- **CRIIS Technologies are Leading Edge**
  - **TSPI Pushing GPS Boundaries**
  - **Secure High Throughput, High Spectrally Efficient Datalink**
- **CRIIS is a Future Enabler**
  - **Conducive to Live, Virtual, Constructive Applications**
  - **Potential Operational Use**



# ***Target Support in a Resource Constrained Environment***

**CAPT William Jensen**  
**Ranges and Targets Readiness Branch Head**

**OPNAV Prisoner #N433**

**27 October 2011**



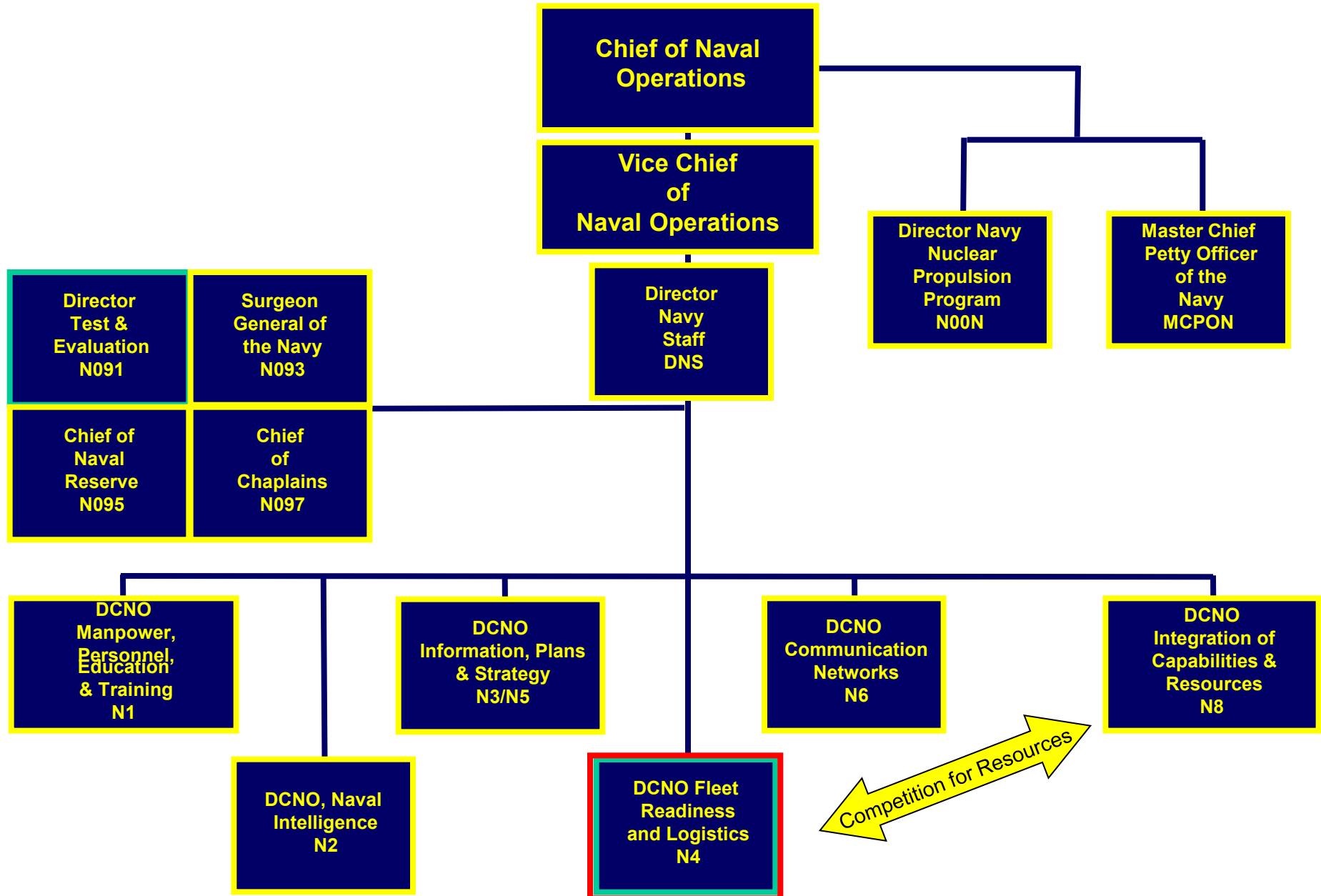


- **Navy Target Program 101**
- **Emergent Unmet Requirements**
- **Inventory Challenges**
- **Target Program Cost Reduction Strategies**
- **“Joint” Use of Targets**
- **Joint Target Opportunities**

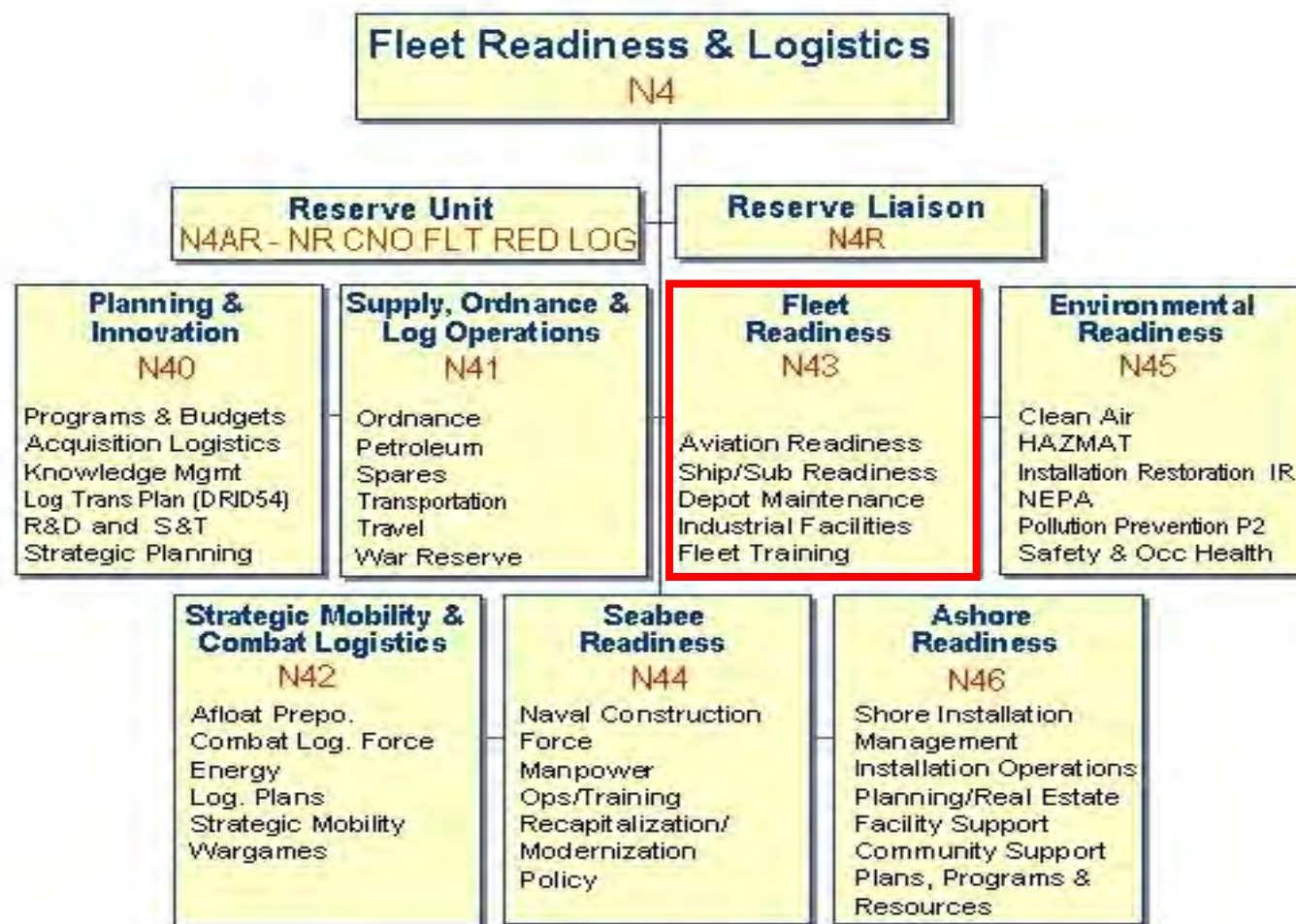




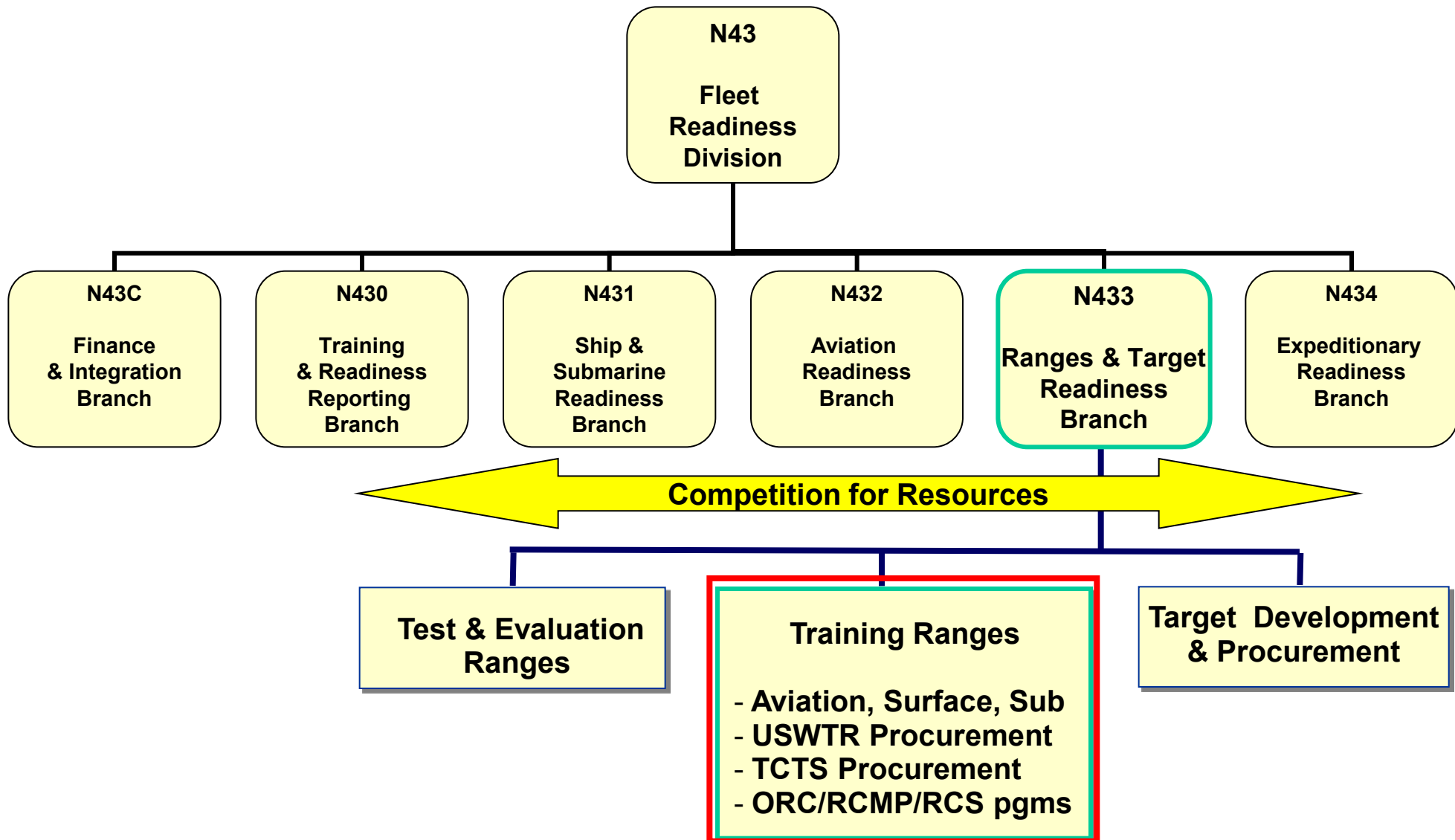
# OPNAV Organization







Competition for Resources among N4 Directorates





# ***Navy Targets Program***

- **Primary Focus: Ship Self Defense Weapon System Tests**

- Anti-Ship Cruise Missile Threat
- Air Threat
- Surface Swarm / Fast Attack Craft Threat
- Mine Threat

- **Target Types**

- Aerial
- Surface
- Subsurface/Submarine
- Mine
- Moving Land Target
- NOT:
  - Helicopter
  - UAV
  - Static Land Targets

- **Training (Presentations and Live-Fire)**

- Anti-Air Warfare
- Surface Warfare/Counter Swarm
- Anti-Submarine Warfare/Counter-Mine
- Strike Warfare





# International "Interest"

**ВОЗДУШНАЯ РАКЕТА-МИШЕНЬ (РМ) BQM-74E** «ЧУКАР» (Shukar), разработанная компанией «Нортроп-Грумман», состоит на вооружении ВМС США и ряда других стран. Она предназначена для имитации атаки противокорабельной ракеты вероятного противника со сложными тактико-техническими характеристиками на корабль (или на береговой объект) во время отработки вопросов противовоздушной обороны корабля (группы кораблей). Старт РМ может осуществляться с пусковой установки (ПУ), размещенной на берегу или на корабле, с применением твердотопливного стартового ускорителя или с борта военно-транспортного самолета типа С-130 «Геркулес». В качестве маршевого двигателя применен турбореактивный J400-WR-404 «Вильямс». Ракета-мишень оборудована аппара-



турой линии телеуправления. При необходимости приводнение аппарата может выполняться парашютным способом с целью возвращения на корабль и дальнейшего использования. Основные ТТХ BQM-74E «Чукар»: длина 3,9 м, размах крыла 1,76 м, диаметр 0,35 м, стартовая масса при запуске с рельсовой ПУ 270 кг, с самолета – 211 кг, максимальная скорость полета 270 м/с, максимальная дальность полета 900 км, высота полета над уровнем моря 2–12 200 м, максимальное время полета 1–36 мин, уровень аэродинамических перегрузок 6 g.



ЗВО – 3/2010

## НА ПОЛИГОНАХ МИРА

ых государств в рамках учебно-продолжается отработка вопросов обороны кораблей (корабль) от ударов противокорабельной ракеты вероятного противника, в том числе и-мишеней (РМ). Дистанционно и-мишеней, развитие которых проявляется ПКР с новыми характеристиками во время учебных стрельб экипажа и средств ПВО корабля на приближенную к боевой.

РМ BQM-74E «Чукар» с фрегата эл Б. Робертс ВМС США (1) и де учений «Унигос» (2). (Основ-данной мишени см. на цветной «Си Дарт» с британского эсминца



проекта 42 (3) для поражения РМ «Мирач-100/5» (Mirach, 4). Основные ТТХ мишеней: разработана компанией «Салвек Галилео», высота полета 3–12 500 м, максимальная скорость полета 925 км/ч, уровень аэродинамических перегрузок (УАП) до 8 g, максимальная продолжительность полета 60 мин. РМ «Ирис Джет» (Iris Jet), запущенная с фрегата ВМС Нидерландов (5). Разработана компанией «ЗСигма» (концерн ЕАДС). Максимальная скорость полета 850 км/ч, высота



полета 10–12 000 м, УАП до 6 g, максимальная продолжительность полета 60 мин. Поражение воздушной мишени «Скуа» (Skua, 6 и 7). Разработана южноафриканской компанией «Денел дайвинкс», ее длина 6 м, размах крыла 3,6 м, масса 160 кг, максимальная скорость полета 0,86 М на высоте 10 000 м, дальность действия радиоканала управления 200 км, высота полета 10–10 700 м).







# *Aerial Targets*

## SUPERSONIC



**AQM-37C**



**GQM-163A  
(SSST/Coyote)**



**ZGQM-173A Multi-Stage  
Supersonic Target (MSST)  
(development)**

## SUBSONIC



**BQM-34S**



**BQM-74E**



**Sub-Sonic Aerial Target (SSAT)  
(development)**

## FULL SCALE



**QF-4**



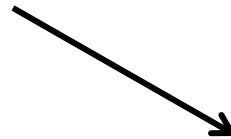
**QF-16**



# *Ground Targets*



QLT-1C



Moving Land Target  
Kairos Autonomi





# Seaborne Targets

P  
O  
W  
E  
R  
E  
D



High Speed Maneuverable Seaborne Target (HSMST)



QST-35



Fast Attack Craft Target (FACT)



Ship Deployable Seaborne Target (SDST)

T  
O  
W  
E  
D



Low Cost Modular Target (LCMT )



Polyethylene Tow Target (PETT)



Low Cost Towed Target (LCTT)



# *Anti-Submarine Warfare Targets*

MK 39/ Expendable Mobile Anti-Submarine Warfare Training Target (EMATT)



MK 30 Mod 2

MK 30 Mod 1



# Mine Warfare Targets



MK 44 MOD 0/1



MK 46 MOD 1



MK 47 MOD 0



MK 48 MOD 0



MK 49 MOD 0



MK 50 Mod 0



MK 51 Mod 0



MK 52 Mod 0



MK 53 Mod 0/1



MK 57 Mod 0/1



MK 58 Mod 0



MK 59 Mod 0



MK 74 Mod 0



MK 75 Mod 0



# Target Program Challenges

- Fiscal Environment – Global Cooling
- Emergent Requirements
- POM vs Execution Year Planning
- Inventory Droughts



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# *Fiscal Realities*

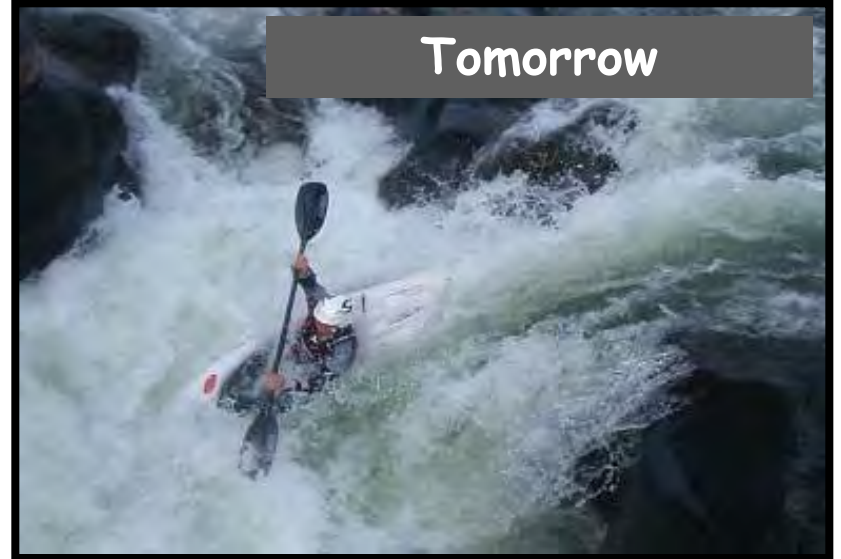
Yesterday



Today



Tomorrow



*We are headed for permanent white water!*



# *Emergent Requirements*

- **Fleet's Return to Aegis Missile Live-Firing for Training**
  - Increase operator proficiency
  - Stresses limited subsonic target inventory
- **Counter Swarm Tactics – Live Fire Training**
  - Assumptions: 100xHSMSTs per coast
  - Stresses limited surface target inventory



USS Bataan (LHD-5) Fast Inshore Attack Craft exercise





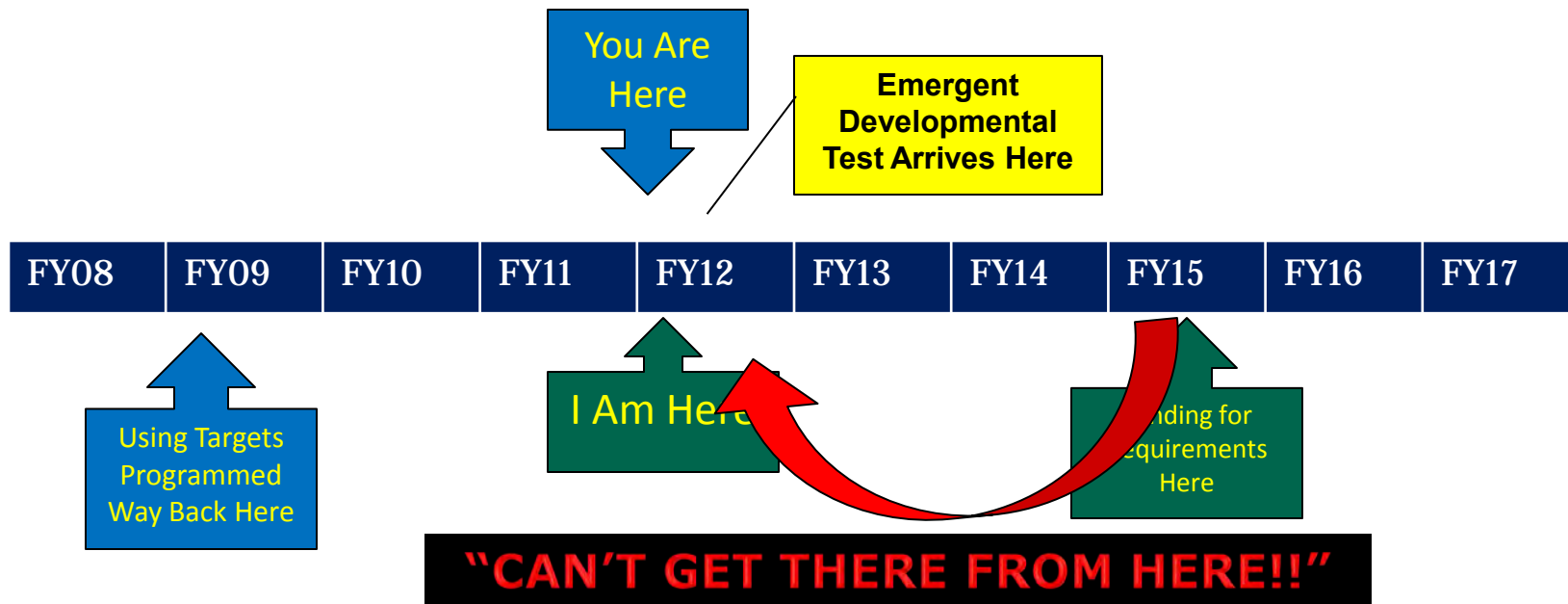
# ***Emergent Requirements***

- **Fleet's Return to Aegis Missile Live-Firing for Training**
  - Increase operator proficiency
  - Stresses limited subsonic target inventory
- **Counter Swarm Tactics – Live Fire Training**
  - Assumptions: 100xHSMSTs per coast
  - Stresses limited surface target inventory
- **Urgent Operational Needs / Quick Reaction Assessment**
  - Fast Attack Craft emergent threat
    - Engagement systems under rapid development
    - Advanced Precision Kill Weapon System / Griffin / Spike / 20mm / Medusa
  - Directed Energy Weapons
    - Maritime Laser Demo
  - UAVs
  - Ballistic Anti-Ship Missile



# ***POM vs Execution Year Planning***

- **Targets Provided Today were Programmed in 2008**
  - POM-11 Planning began in October 2008
  - POM-11 Finalized April 2009
  - Procurement in 2011 -> 2012 Delivery
- **POM14 Planning = Deliveries in 2015!**
- **Increased Execution Year Requirements -> Out-year Programs at Risk**

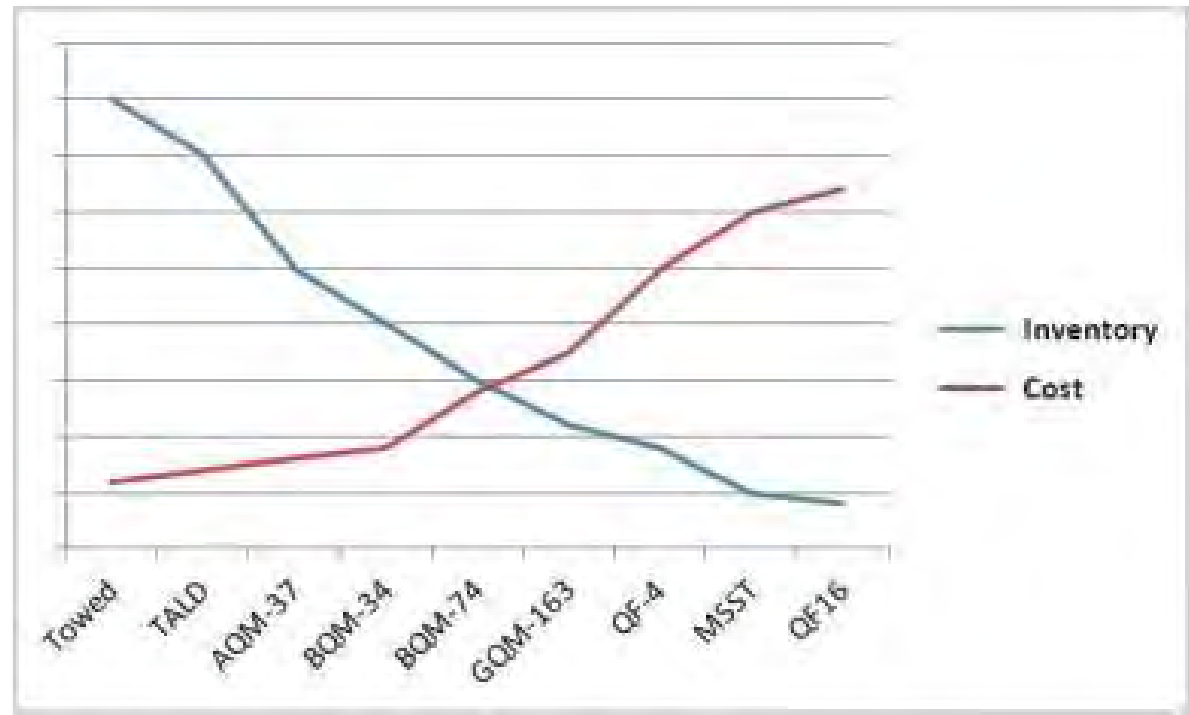




# Inventory Challenges

- **Threat Realism**

- Signature: RF Signal, RCS, IR
- Profile: Dive, Sea-Skimming
- $\uparrow$  Capabilities =  $\downarrow$  Inventories





# Target Tradeoffs

LENGTH



**Self-Deployable Surface Target (SDST)**  
11.5 ft

**Poly-Ethylene Tow Target (PETT)**  
15 ft

**Low Cost Modular Target (LCMT)**  
16 ft / 24 ft

**High Speed Maneuvering Surface Tgt (HSMST)** 26 ft

**Fast Attack Craft Target (FACT)**  
50 ft

TOP SPEED/SEA STATE (SS)



25 knots SS2

25-30 knots SS1

48 knots SS0  
20 knots SS2

46+ knots SS0  
35 knots SS3

56+ knots SS0  
50 knots SS2

REPLACEMENT COST



~\$5,000

~\$15,000

~\$35,000

~\$180,000

~\$700,000



# *Inventory Challenges*

- **Threat Realism**
  - Signature: RF Signal, RCS, IR
  - Profile: Dive, Sea-Skimming
  - ↑ Capabilities = ↓ Inventories
- **Multiple Target Operating Sites**
  - Minimal on-hand inventory requirements
  - Backup targets on the rail
- **Subsonic Aerial Target Gap**
  - 5 year production gap from BQM-74 contract to SSAT first delivery
  - MILCON requirement to support BQM-34 move from Wallops to Dam Neck
  - Over 100 non-RFI BQM-34s (Legacy control systems)
- **Target Recovery Reliability**
  - Recoverable targets lost at sea



***“Have you seen me?”***







# *Target Program Cost Reductions*

## **Four pillars to Navy Target Total Cost Ownership accountability**

- **Target Survivability**
- **Inventory Preservation**
- **Enterprise Developmental/Operational Testing**
- **“Joint” Target Support**





# *Aggressive Expenditures*

*"The second target, target 4, was damaged to the point where it was declared unsafe for recovery and therefore sunk"*



USS Greenbay (LPD-20)

Combat System Ships Qualification Trials

Oct 2009



# *Target Survivability*

- **Tight Rules of Engagement**

- Clear test/training objectives
- Cease fire when test/training objectives are met
- Weapon system operator change of mindset/behavior

- **Target Augmentation**

- Flares / Chaff / Towed decoy
- Proximity target
- Kill sensors on skin of target
- “Humannequin” target
  - impact sensor scoring system



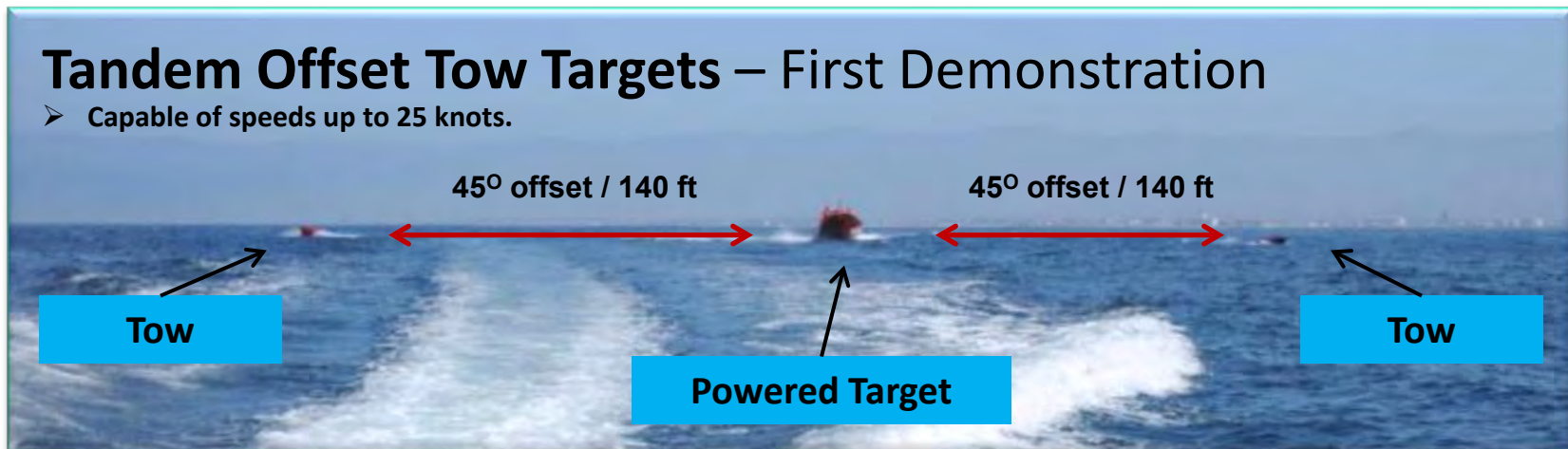


# *Inventory Preservation*

- **Target Substitutes**

- Press for lower cost target when threat representation is less critical
- Heavy dependence on Modeling & Simulation
- Numerous Target Tracking events prior to Live Fire

- **Tow Targets = Increased Raid Count**



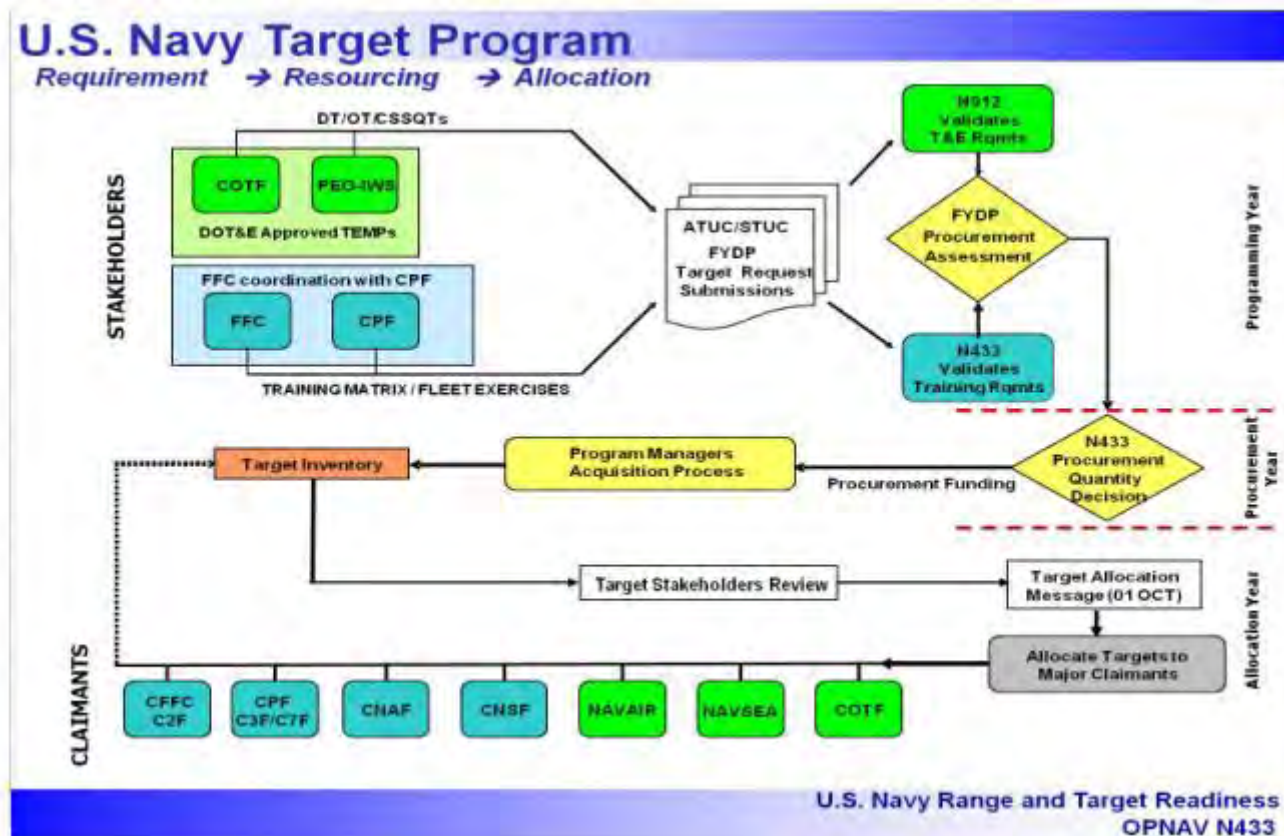




# Inventory Preservation cont.

- **Stringent Requirements Validation Process**

- Requirement must be documented
  - Test and Evaluation Master Plan (TEMP)
  - Training and Readiness Matrix







# *Inventory Preservation*

- **Target Recovery – an “All Hands” effort**
  - Delineated in Test Plan
  - Shooter to assist with locating target
  - Augment target with signaling device(s)
  - Schedule for recovery to occur in daylight
  - Helicopter airborne in vicinity of ops
  - Contracted helicopter service since 1996
    - 675 aerial targets recovered
    - \$281M replacement costs avoided

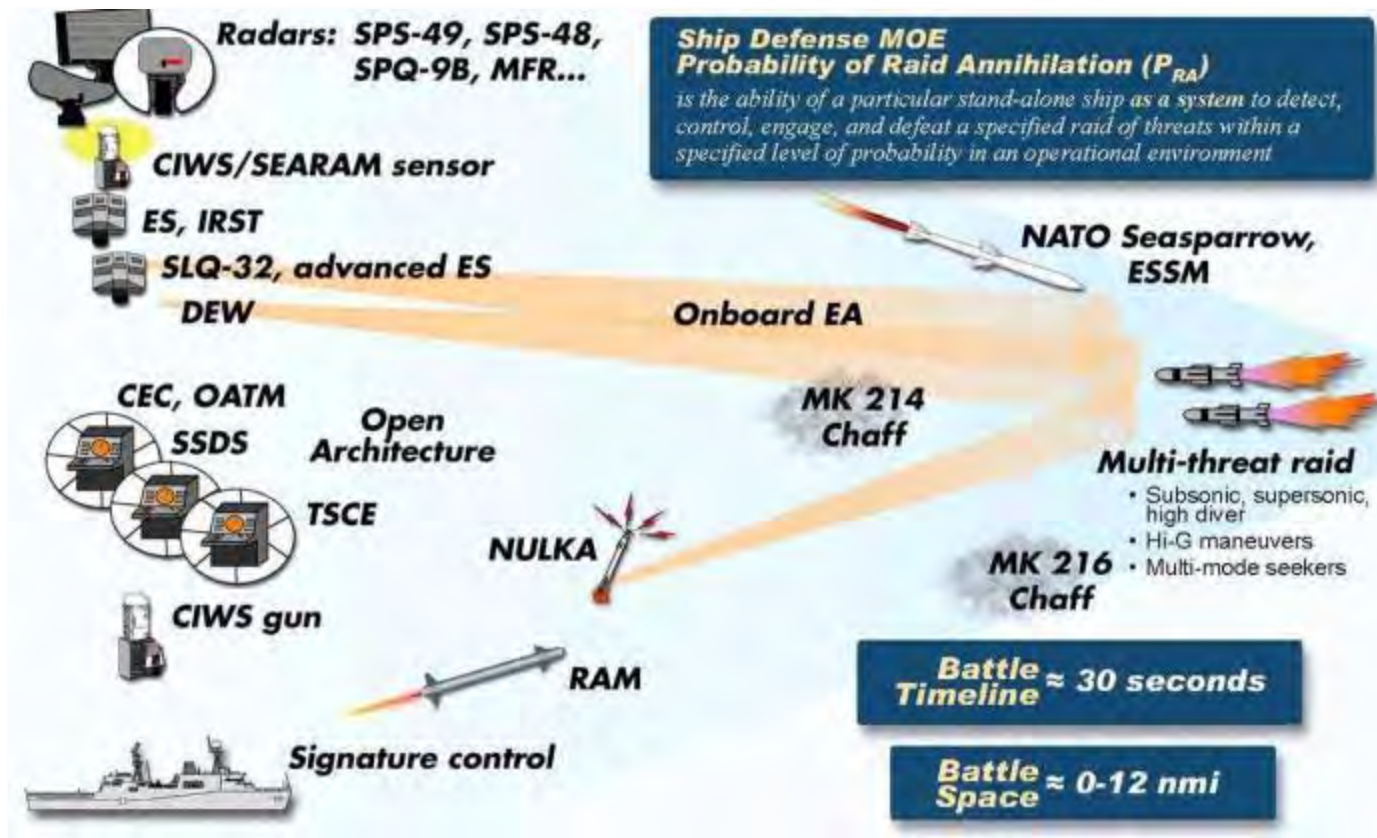




# Enterprise Testing

## • Multiple Weapons System Tests vs One Target Set

- Consolidation of Air Warfare Ship Self Defense at-sea testing
- Different hulls, different configurations...same threat models, same range conditions
- Many specific parameters, assumptions, and limitations are negotiated between the testing and acquisition communities
- Validate models with live testing





# ***“Joint” Target Support***

- **JSF Testing at Pt Mugu and China Lake**
  - BQM-167 (USAF) and BQM-74 (USN)
- **U.S. Army**
  - Joint Land Attack Cruise Missile Defense Elevated Sensor (JLENS)
    - Aerostat tracking of BQM-74s
- **USAF**
  - White Sands – USAF Low Altitude Tracking (BQM-74)
  - F-15 Targeting Capability Upgrades (BQM-74)
  - F-22 Testing at China Lake (BQM-34)
  - F-22 /AFOTEC Testing at Utah Test and Training Range (UTTR) (BQM-74)



# ***“Joint” Target Support cont.***

- **USAF-USN Full Scale Aerial Target (QF-4 / QF-16)**
- **USAF support to Navy Weapons Evaluation Program**
  - BQM-167 targets for air-to-air tactics development
- **Coast Guard**
  - Target support to maritime weapon systems
- **Moving Land Target has USA/USAF interest**
- **Navy has the “Monopoly” on Surface and Mine Targets**



# ***“Joint” Target Control System Development***

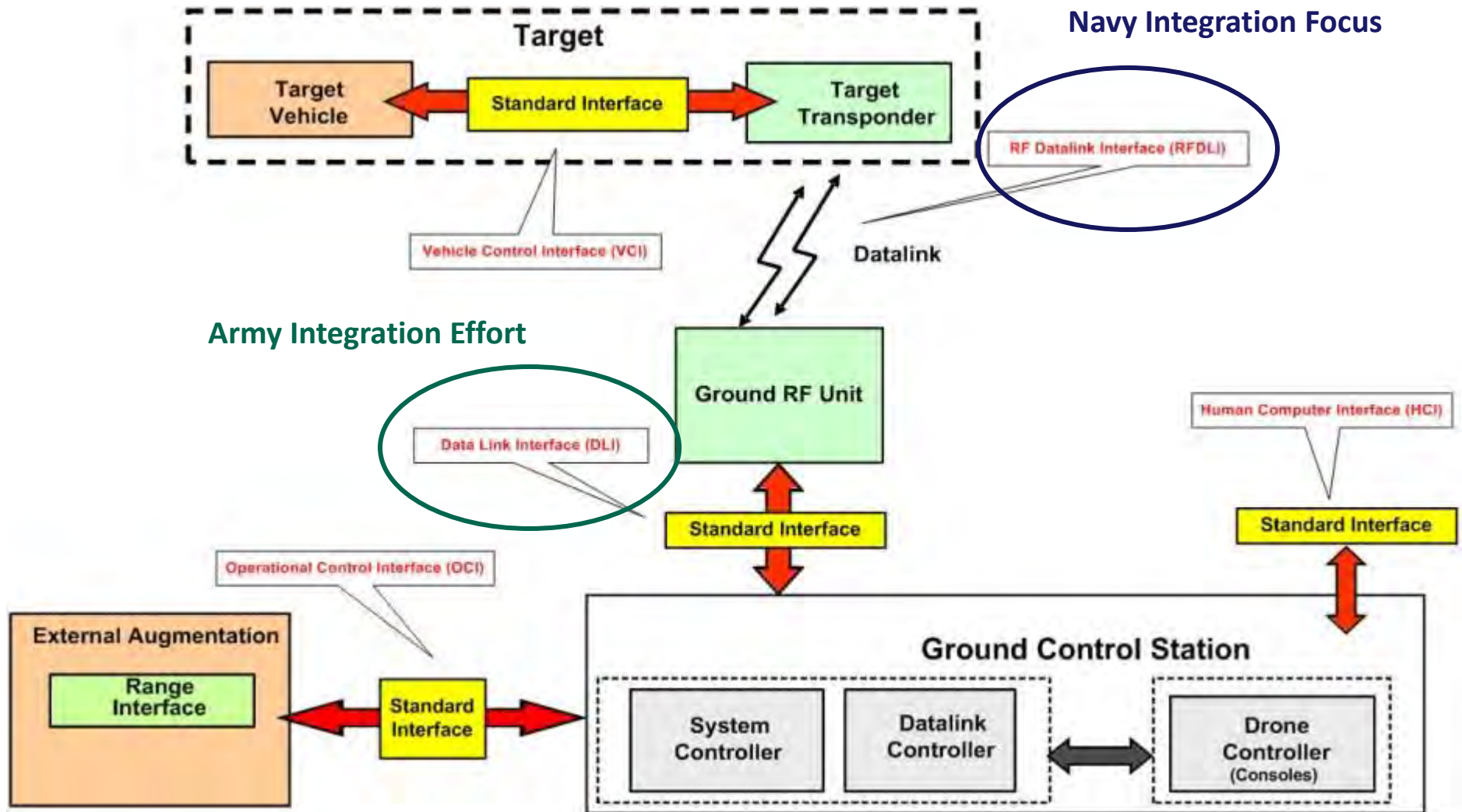
- **Common Target Control System**

- DOT&E standard target control interface initiative
  - “Develop Tri-Service Standard Interfaces to reach interoperability by developing hardware independent interfaces for Ground Target Control System, Ground RF unit, and Target transponder”
- Army updating Data Link Interface (DLI) from DOT&E DLI baseline
  - Army test complete Jan–Feb 2012
- Navy to assess Army Target Common Control System (ACCS) DLI variant for incorporation into a future Standard Navy Target Control (SNTC) ECP
  - Navy engaging with Army development/testing
- Navy to recommend a standardized RF DLI format that is optimal for Navy aerial and surface targets
  - OSD to evaluate Navy RF DLI format proposal, if supportable, OSD will socialize with USAF + USA at Target Control Steering Groups for adaptation for service-unique requirements





# DOT&E TCS Initiative





# ***Possible Joint Target Opportunities***

- **Unmanned Aerial Systems – Threat Surrogate**
  - No Program of Record for the UAV target program
  - Numerous unmet UAV training requirements
    - However, Training customers disagree over threat requirement
  - Navy Aegis program procures Vindicator target services directly from Meggitt
- **Helicopter Target**
  - Navy Training needs unmet
  - Navy Tests (limited) vs Army helicopter targets
- **Hypersonic Development**
  - DOT&E pressing for test against next generation threat
- **Moving Land Target**
  - Kairos Autonomi: 60 targets for Navy training
  - USA/USAF interest



- **“More with Less” - really?**
  - Requires co-service/tri-service commonality
  - Requires cross service target support
  - Decreased threat representation on most tests
- **Vendor survival requires migration away towards single customer solution**
  - DoD acquisition process makes new development unrealistic for targets
  - Generic -“off the shelf” target solutions are more desirable



# Questions?

Photo# 80-G-12906 X-Wing Fighter in catwalk on the USS Long Island after landing accident July 1942





# *Backup Slides*





# LSTS vector scoring system – proof of concept test results

Firing trials March 2011, NSWC test range, Dahlgren VA



50  
YEARS  
OF INNOVATION

NDIA targets and ranges conference

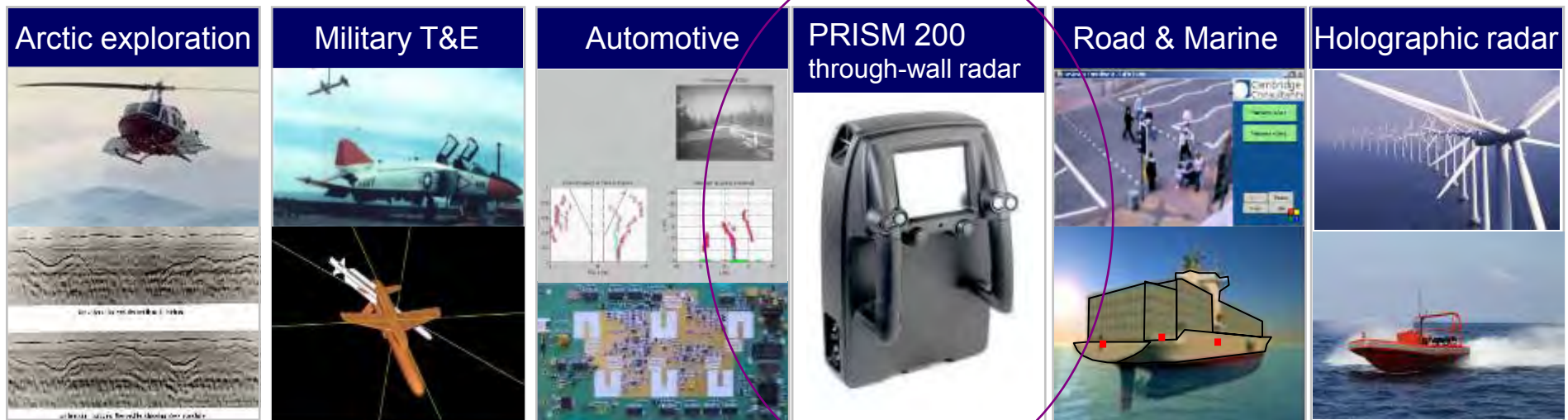
Gary Kemp

- 1 Short introduction to Cambridge Consultants**
- 2 LSTS development program**
- 3 Trials results from March 2011**
- 4 Program going forwards**
- 5 Questions**

## Radar at Cambridge Consultants

### We are a leader in short range radar systems development and a supplier of specialist systems

- Over thirty years' experience in developing radar sensors
  - Missile test and evaluation systems – ARMS vector scoring system
  - 3D imaging radar systems – automotive, through-wall, infill
  - Holographic radar – real-time performance in heavy clutter for infill and scoring



1980 —————→ 2011

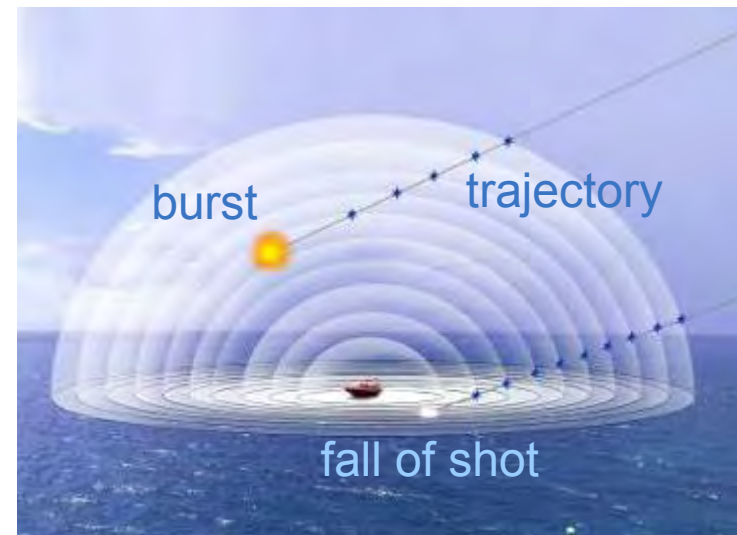
- 1 Short introduction to Cambridge Consultants
- 2 **LSTS development program**
- 3 Trials results from March 2011
- 4 Program going forwards
- 5 Questions

## LSTS

**Land and Surface Target Scorer (LSTS)**

- The Land and Surface Target Scorer is a real-time vector scoring system for highly mobile targets operating in very cluttered environments.
- The LSTS proof of concept development was funded by the OSD Target Management Initiative program, sponsored and managed by NAWC-WD, Point Mugu, Target Systems Division, 5.3.1

## HSMST



1000ft scoring volume



## LSTS Performance requirements

### Key functionality of the LSTS system

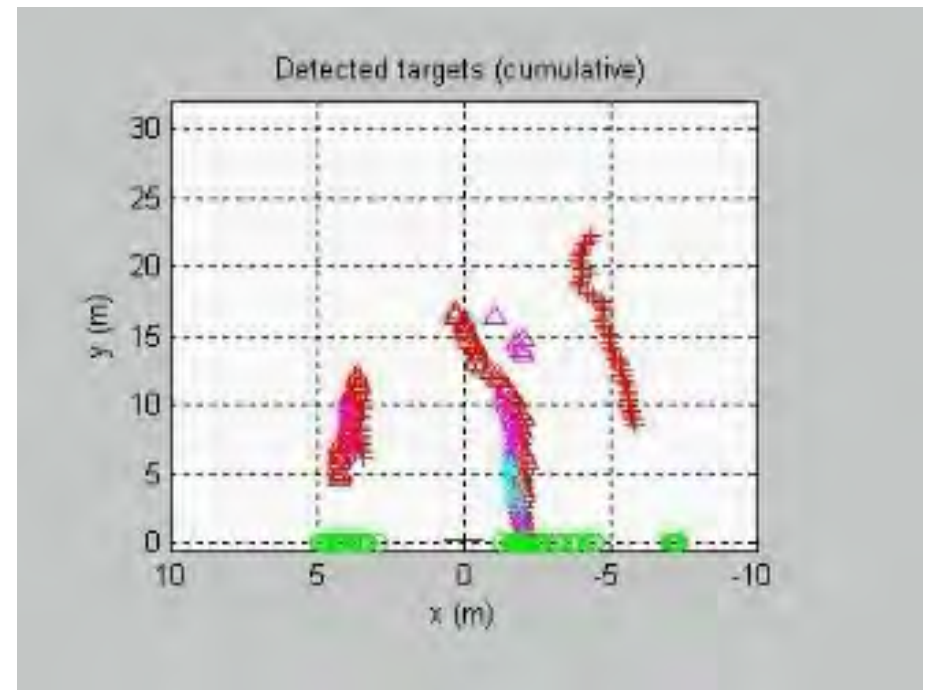
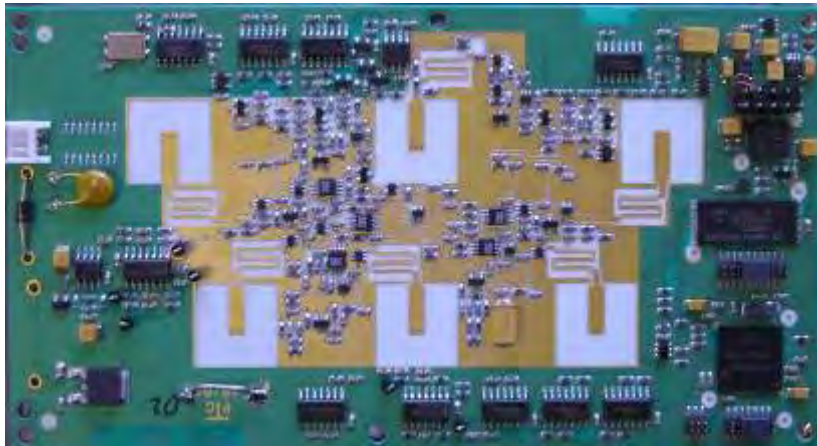
Parameter	Final system	PoC system
Coverage	Hemispherical	Quadrant
Range (5" shell)	1000 feet	330 feet
Range (.50 calibre)	300 feet	100 feet
Firing rate	20 rounds per minute	40 seconds continuous capture
Projectile closing velocity	2500ft/sec	2500ft/sec
Simultaneous operation	up to 4 targets with not less than 1000 ft separation	1 radar operating required
Reporting	Real-time	15 minutes

## LSTS origins

**Land and Surface Target Scorer (LSTS)**

- We had already developed a small, single card holographic radar system that tracks multiple targets in real time, for the automotive market.
- We had tested a variant of this system in longer range and in marine applications.

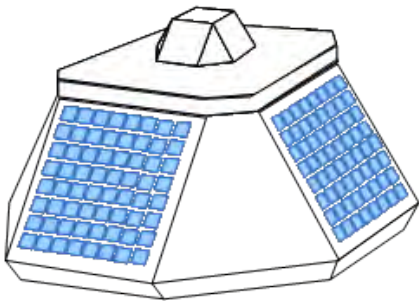
‘SPOT’ radar 6" x 3.1"



## LSTS development

**Land and Surface Target Scorer (LSTS) Proof of Concept system**

- The system was developed from start to TRL6 in 15 months.
- The proof-of-concept equipment has been engineered to a form that is close to that of the final system.



Concept

Jan 2010



CAD design

June 2010



Build

Nov 2010



Sea trials

Mar 2011

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## LSTS Proof of Concept equipment

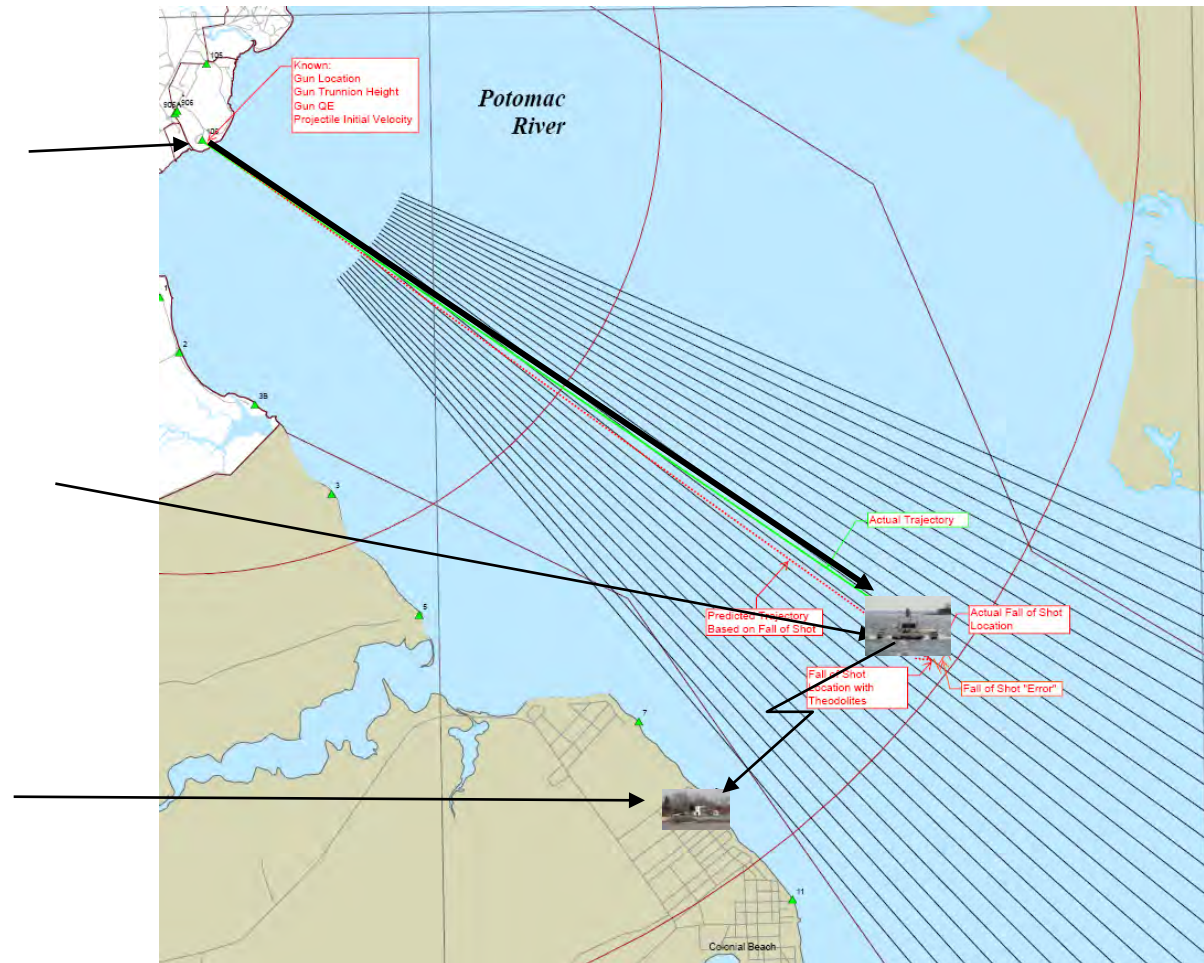
### PoC system – Sensor Head, Radar Data Processor and Battery





## LSTS Proof of Concept trial, Potomac River, Naval Surface Warfare Center, Dahlgren VA

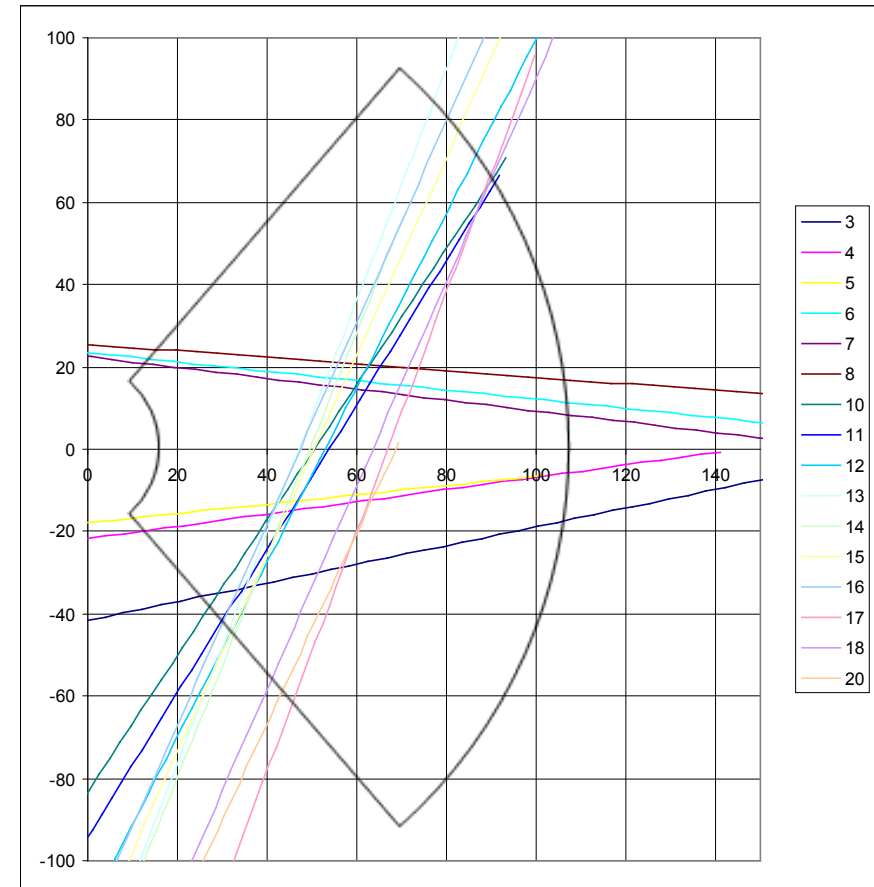
### Sensor pontoon 9000 yards down range



## Trials results

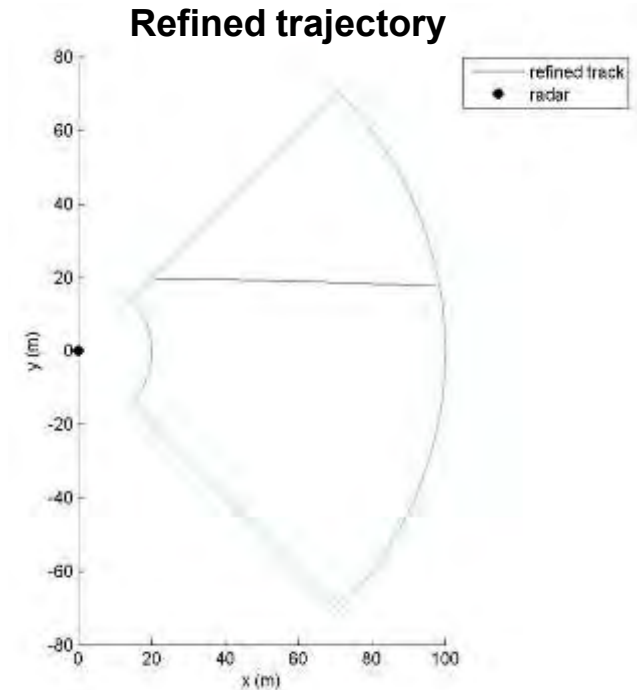
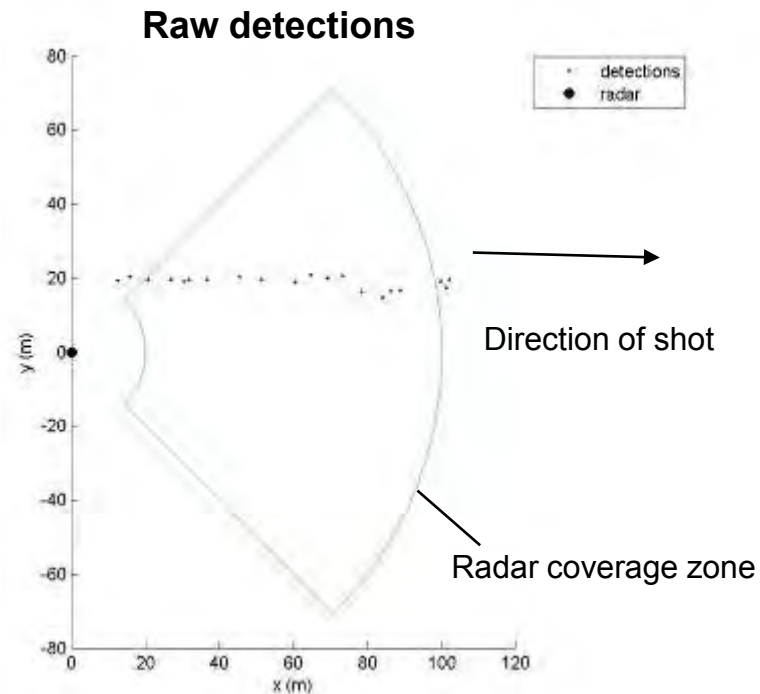
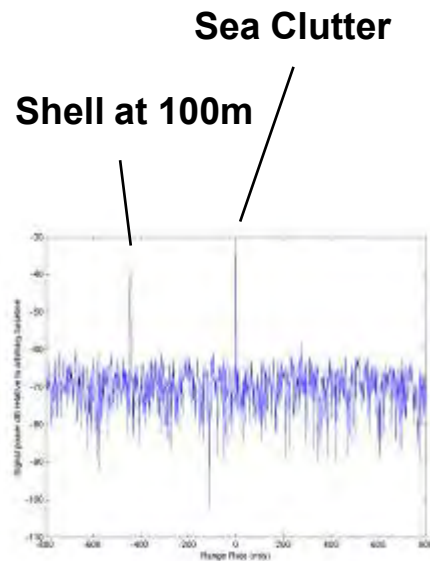
### PoC Demonstration Results

- 16 x 5" shell shots scored:
  - mixture of BL&P and HE
  - Mixture of up-range, down-range and broadside trajectories
  - One 4-shot burst (3 second intervals)
- Results confirmed predicted performance:
  - good detection rate
  - good discrimination from clutter
  - good signal-to-noise at longest range
  - low noise on individual position estimates
- Ability to detect distinctive splash point and blast point returns



## LSTS

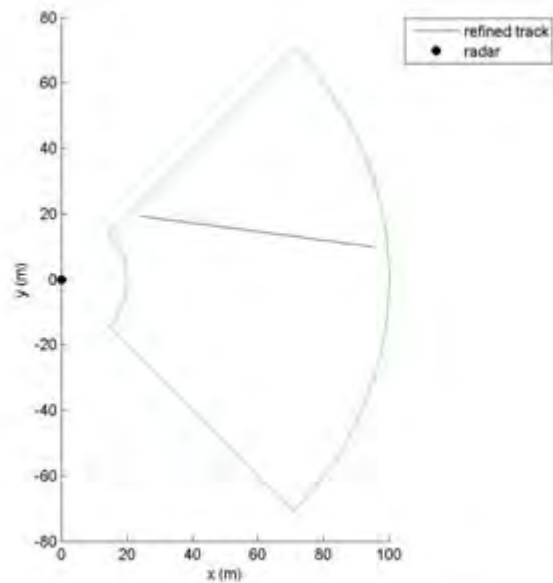
A tracked trajectory of a 5" shell fired from 6 miles range over the top of our radar with a muzzle velocity of 800m/s



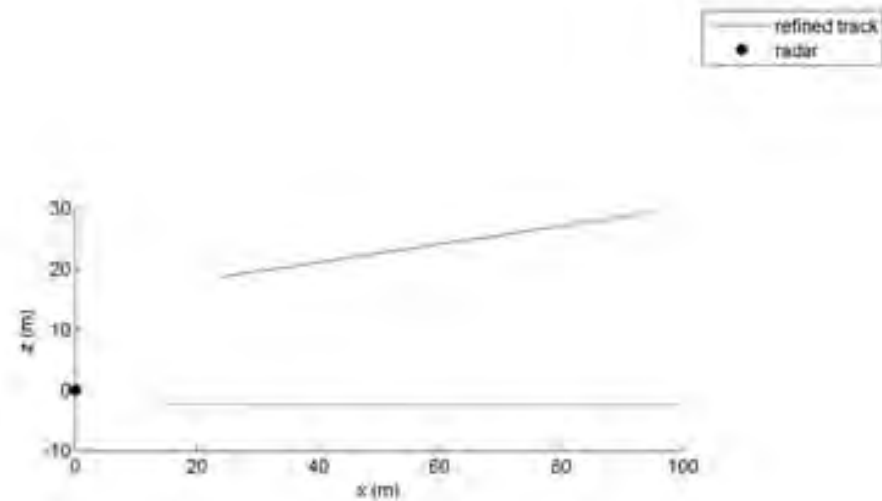
## Trials results

## Up-range shot

Plan view



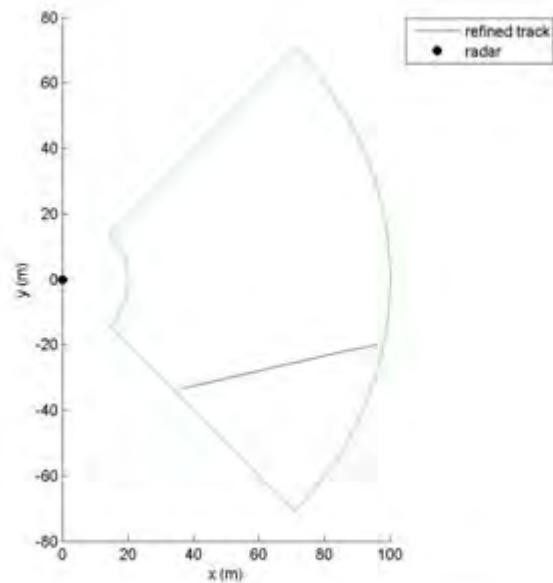
Elevation view



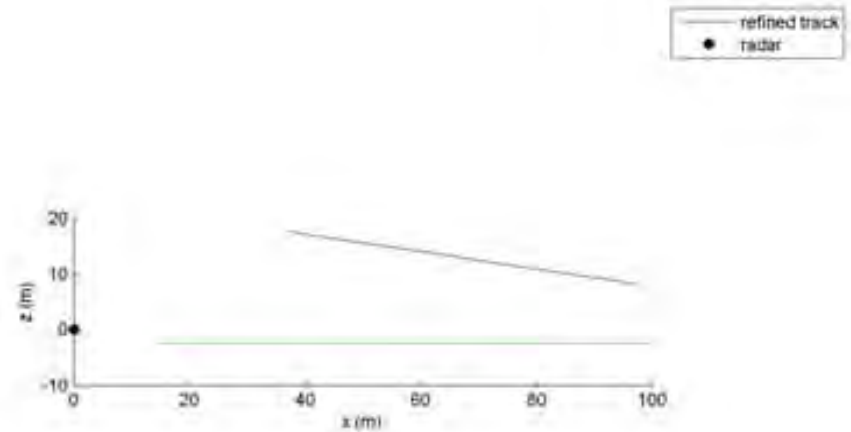
## Trials results

## Down-range shot

Plan view



Elevation view

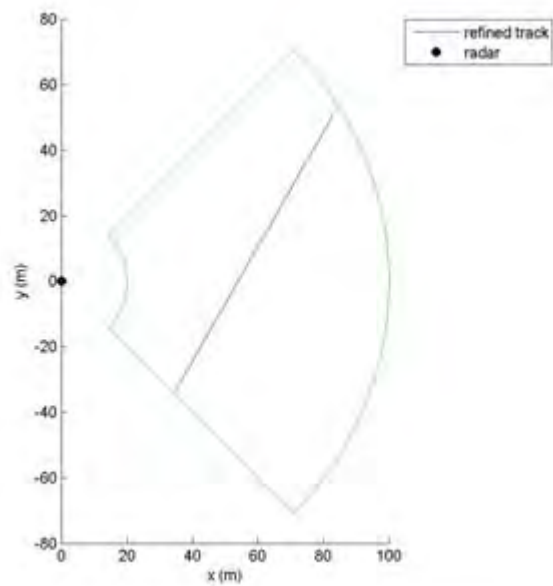




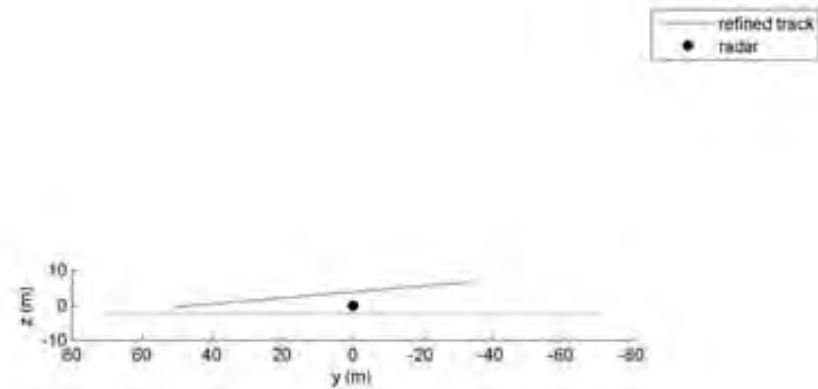
## Trials results

## Cross-track shot

Plan view

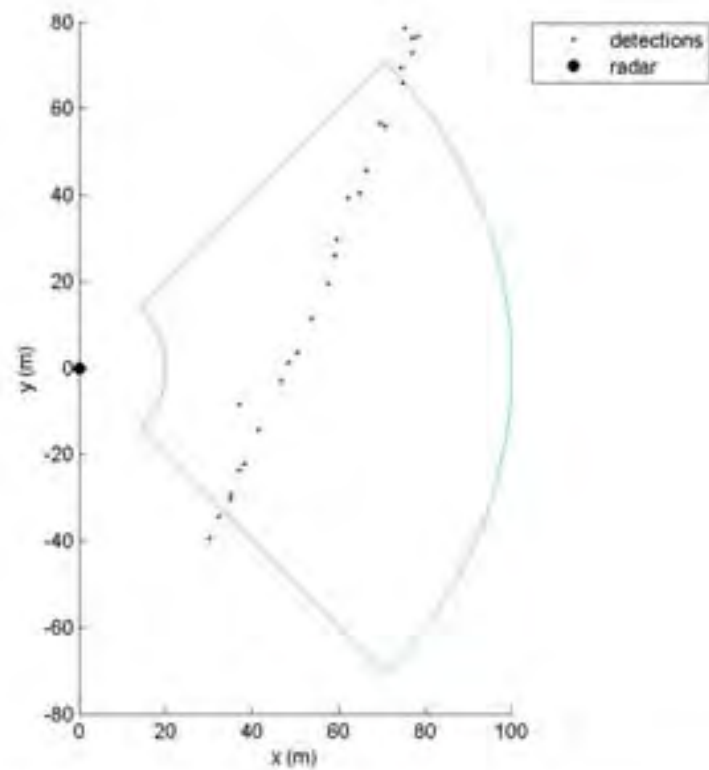


Elevation view



## Trials results

## 4 shot burst



## Trials results

### HE shot



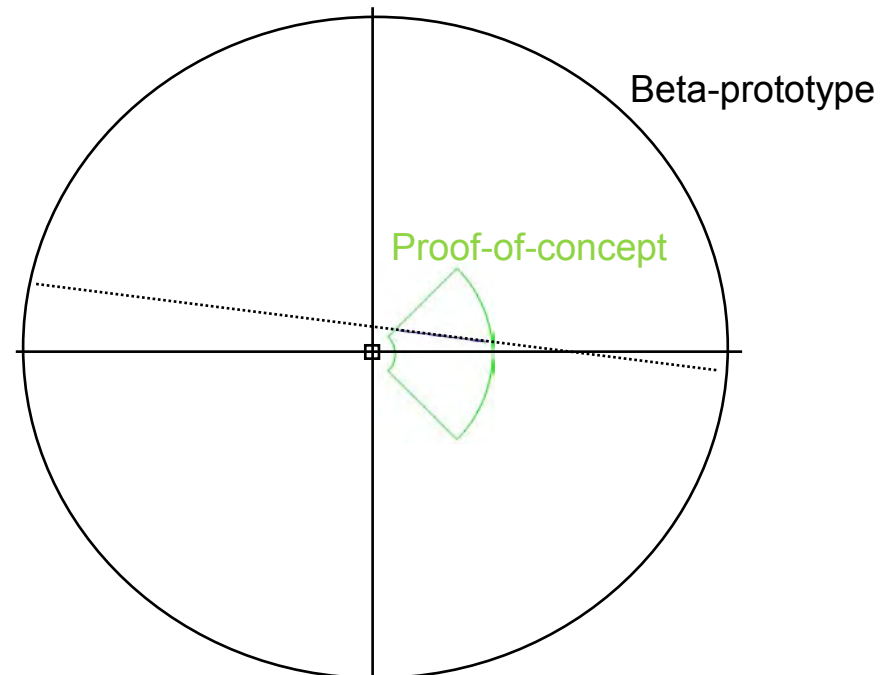
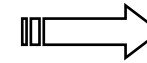
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## LSTS

## Land and Surface Target Scorer Beta-prototype build

### Beta prototype phase to include:

- Scale up to 1000' range
- Full hemispherical coverage
- Real-time processing
- Trials on fixed and mobile platforms
- Trial against 50 cal





## Questions?



## Contact details:

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# **U.S. Navy Aerial Target Systems**

**Presented to 49<sup>th</sup> Annual NDIA Symposium**

**27 October 2011**

**Fort Walton Beach, FL**

**Captain Dan McNamara**  
**Program Manager**  
PMA-208, Navy Aerial Target & Decoy Systems

**Mr. Tim Barnes**  
**Principal Deputy Program Manager**  
PMA-208A, Navy Aerial Target & Decoy Systems



# Outline



- Product Line
- Operating Sites
- Supersonic Targets
- Subsonic Targets
- Full Scale Targets
- Target Control System
- Foreign Military Sales
- Challenges





# PMA-208 Target Product Lines



## Supersonic



GQM-163A



AQM-37C



GQM-173A  
Multi-Stage  
Supersonic Target (MSST)  
(development)

## Subsonic



BQM-34S



BQM-74E



Subsonic Aerial Target  
(SSAT)  
(development)

## Full Scale



QF-4



QF-16

Moving Land  
Target (MLT)  
(development)



## Other/Support



Tactical Air  
Launched  
Decoys



Common  
Equipment /  
Augmentation



Threat  
Simulation



Banners



System for Naval Target  
Control (SNTC)





# Operating Sites

✦ GQM-163 capability at Point Mugu CA and the following ranges:

- Stood up Pacific Missile Range Facility Hawaii in 2010 - Stood up Levant Island France (via FMS case) in 2011, first launch 2012



## Air Launch:

BQM-34  
AQM-37  
BQM-74



## Ground Launch:

BQM-34  
BQM-74  
SSAT  
GQM-163  
GQM-173



## Ship Launch:

BQM-34  
BQM-74  
SSAT





# GQM-163A



## Supersonic Sea Skimming Target

- Prime Contractor: Orbital Sciences Corporation
- Production
- Emulates supersonic sea skimming anti-ship cruise missile threats
- Targets Expended to date: 17
- Operations to date: 11
  - 6 Oct 2005 (1)
  - 12 and 13 Jun 2007 (2)
  - 12 Dec 2007 (2 as stream raid)
  - 3 Dec 2008 (1)
  - 18 Dec 2008 (2 as stream raid)
  - 9 Dec 2009 (2 as stream raid)
  - 15 Jan 2011 (1)
  - 29 June 2011 (1) – PMRF HI
  - 30 June 2011 (2 as stream raid) – PMRF HI
  - 29 Sep 2011 (2 as stream raid)
- Demonstrations to date: 3
  - 8 June 2010 (1 as EPOD)
  - 8 July 2010 (1 as High Diver)
  - 8 December 2010 (1 as Orbital Front End Subsystem (OFES))



### Current Inventory 33

28 targets in work  
(1 Heritage / 27 OFES)

Preparations to support two operations at SNI Oct-Dec 2011



# AQM-37



- Medium to high altitude supersonic cruise with dive capability
  - Mach 2.0 – 4.0
  - Range 100 mi
  - Altitude 1000 ft – 100 Kft
  - Demonstrated TBM profiles (300 Kft, 120 nmi downrange)
  - F-16 launch platform (MOA with ANG)
- Out of production system
  - Last Delivery Dec 2001
  - 48 AQM-37C in inventory; 30 AQM-37D (USAF flight clearance expected 2<sup>nd</sup> Qtr FY2012)
  - GPS range tracking/scoring capability (JAMI)
  - Capability to provide power dive
- Historically have conducted approximately 6-12 operations per year (some FMS)
- Low fidelity high-diver



## **Current Inventory 78**

FY08 Ops/Expenditures – 5/8  
FY09 Ops/Expenditures – 8/10  
FY10 Ops/Expenditures – 7/7  
FY11 Ops/Expenditures – 7/8





# GQM-173A



## Multi-Stage Supersonic Target (MSST)

- Replicates a family of multi-stage supersonic ASCM Threats
  - Subsonic cruise with transition to supersonic terminal phase
- Program in Engineering & Manufacturing Development (EMD) phase
  - MS B completed August 2008
  - EMD contract awarded to Alliant Techsystems Incorporated (ATK), Woodland Hills, CA
  - EMD effort planned for 4.5 years
  - Planned Initial Operational Capability in FY14
- Program Status
  - Program designated nomenclature GQM-173A
  - Technical activities completed
    - System Requirements Review (SRR) Jun 09
    - Integrate Baseline Review (IBR) Jul 09
    - System Functional Review (SFR) Dec 09
    - Software Specification Review (SSR) Mar 10
    - Preliminary Design Review (PDR) Apr 10
    - Critical Design review (CDR) Feb 11
    - EEU prototype flight test May 11
  - Activities planned
    - Test Readiness Review and Flight Readiness Review planned for Nov 11
    - First EDM flight test planned for Feb 12





# BQM-34S



- Prime Contractor: Northrop Grumman
- Sustainment
- Missions
  - Low fidelity A/C simulator
  - T&E workhorse – special configurations
    - Open Loop Seeker (OLS) integration
  - Launch: ground, ship, air
- Product Improvements
  - Upgraded Integrated Avionics Unit (UIAU) integration fielded Oct 09:
    - Replaced existing autopilots with UIAU from BQM-74
    - Common avionics, radar altimeter, Support Equipment with current production BQM-74E
    - Addressed obsolescence issues
    - Reduced logistics
    - Allows for performance growth if required
    - 20 retrofits completed

## Current Inventory ~ 191

FY07 Ops/Expenditures - 14/3

FY08 Ops/Expenditures - 12/0

FY09 Ops/Expenditures - 4/1

FY10 Ops/Expenditures – 18/1

FY11 Ops/Expenditures – 18/6



Great T&E “Truck” but does not adequately represent many of today’s threat ASCMs





# BQM-74E



- Prime Contractor: – Northrop Grumman
- Sustainment
  - Training and T&E workhorse
  - Final delivery **Dec 10**
- Missions:
  - High fidelity Anti-Ship Cruise Missile (ASCM) Surrogate
  - Low-fidelity A/C simulator
  - Launch: ground, ship, air
- Product improvements
  - Programmable semi-autonomous navigation
    - Selectable Lost Carrier Sensitivity from waypoint to waypoint
    - Return to Recovery Area
    - Planned fielding FY12

## Current Inventory ~ 339

FY07 Ops/Expenditures - 158/52

FY08 Ops/Expenditures - 231/68

FY09 Ops/Expenditures - 207/46

FY10 Ops/Expenditures - 200/49

FY11 Ops/Expenditures - 129/24



Target still adequately represents many but not all threat ASCMs



# Subsonic Aerial Target (SSAT)



- Provides increased subsonic performance capabilities to improve fidelity in representing aircraft and missile threat characteristics
- Prime Contractor: Composite Engineering, Inc. (CEi), Sacramento, CA
  - Three Year EMD program
  - Two production options
  - Options for Contractor Logistics Support
- Chronology
  - ✓ Contract Awarded 28 Jan 2011
  - ✓ Wind Tunnel Testing successful May 2011
  - ✓ SRR 8<sup>th</sup>-9<sup>th</sup> Aug 2011
  - ✓ IBR 26<sup>th</sup>-30<sup>th</sup> Sep 2011
  - SFR/PDR/SSR Feb 2012



KPP's (Complete details in CDD)	OBJECTIVE	THRESHOLD
Maximum Speed at Low Altitude [Mach (M) at feet (ft) above wave crest]	≥ 0.95 M @ 6.6 ft in WMO SS 5	≥ 0.90 M @ 10 ft in WMO SS 3
[Terminal Altitude [ft above wave crest]	≤ 6.6 ft @ 0.95 M in WMO SS 5	≤ 10.0 ft @ 0.9 M in WMO SS 3
Terminal Maneuverability [Constant Gravitational Force (g)]	8.0 g sustained	6.0 g sustained
Maneuverability During Programmable Weave [Instantaneous g at Minimum Altitude and Maximum Speed]	≥ 8.0g instantaneous at 6.6 ft altitude and 0.95 M	≥ 6.0g instantaneous at 10 ft altitude and 0.9 M
Radar Cross Section (RCS) Reduction [X-band, monostatic]	≤ -17.0 dBsm	≤ -14.6 dBsm
Target Size Characteristics [inches (in)]: Length/ Diameter	Threshold = Objective Threshold = Objective	149.0 - 258.0 in 13.0 - 21.0 in
Material Availability ( $A_M$ )	≥ 95%	≥ 85%



# QF-4/QF-16

## Full Scale Aerial Targets



- Provides Threat Representative Target capabilities to meet Public Law Title 10 US Code 2368, that New and Improved Weapon Systems demonstrate Lethality prior to Production
- QF-4 Full Scale Aerial Target
  - A/F led procurement
  - A/F provides Operational, Maintenance & Sustainment services at Tyndall and Holloman
  - Navy procurements from USAF (FY03 –FY10)
    - Total Navy quantity procured: 27
  - Navy trading QF-4's for BQM-167's to support (N)WSEP
    - 1 QF-4 traded for 4 BQM-167's in FY08
    - 3 QF-4's traded for 10 BQM-167's in FY10
- QF-16 Provides 4<sup>th</sup> Generation to replace QF-4
  - A/F led development with Army/Navy participation
  - A/F awarded pre EMD contract to Boeing St. Louis Mar 10
  - MS B/Low Rate Initial Production buy 3QFY13
  - MS C/Full Rate Production 2QFY14
  - Planned Initial Operating Capability in 3QFY15
  - Planned Full Operating Capability in 2QFY16



### Available QF-4 Inventory 17

FY07 Ops/Expenditures - 4/2

FY08 Ops/Expenditures - 2/2

FY09 Ops/Expenditures - 1/1

FY10 Ops/Expenditures - 1/0

FY11 Ops/Expenditures –2/1

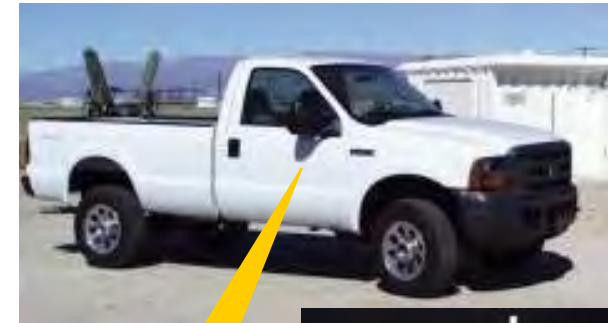




# Moving Land Targets (MLT)



- Provide threat representative MLT to train aircrews in the demands of Close Air Support, Time Sensitive Targeting, Target Identification and Forward Air Controller Procedures
- Program in Production & Fielding
  - Abbreviated Acquisition Program (AAP)
  - Full & Open Competition held for production of logistics support
    - Base year contract with 4 priced options
    - Firm Fixed Price Production and Cost Plus Incentive Fee for logistics support
  - Contract awarded to Kairos Autonomi, Inc., Sandy, UT 1 Apr 2011
  - Milestone C conducted Mar 2011
  - Initial Operational Capability 1QFY12



•Nav



# System for Naval Target Control (SNTC)



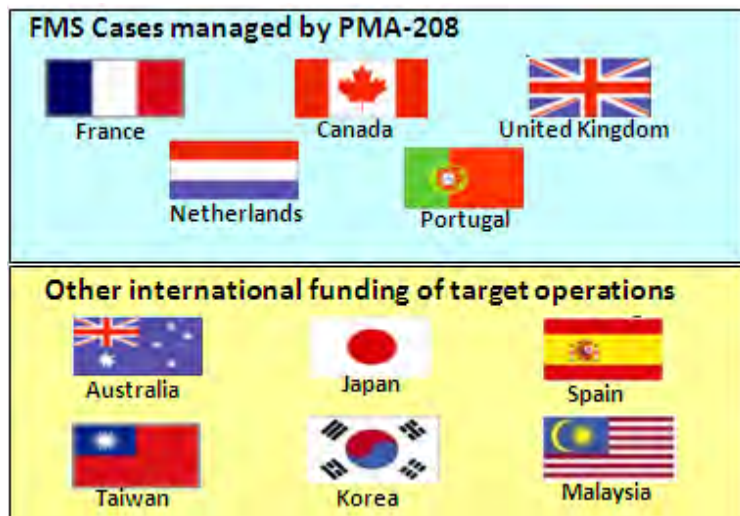
- SNTC
  - Prime Contractor: Micro Systems, Inc
  - Controls BQM-74/34 aerial targets & seaborne targets
  - UHF 435–450 & 358-380 MHz
  - 200 nm line of sight
  - 330 nm via Relay
  - Supports Training and T&E
- Several hardware and software upgrades scheduled due to:
  - frequency limitations and interference
  - information assurance requirements
  - hardware obsolescence
  - new target types







# Foreign Military Sales (FMS)



## Background

**PMA-208 manages 8 active cases / 1 Lease Agreement**

– 8 countries / Case Values Total: \$ 29M

• Other international funding of target operations = FMS case managed by NAVSEA, Range or some other source such as a cooperative program

• If the USN is hosting an event for a country not noted here (FMS case or 'other') the funding source for target reimbursement may be in question

## Description

- **PMA-208 Hardware Case**
  - USN is reimbursed for Targets & TAAS expended from USN inventory in support of international operations on US ranges
  - Some are managed by PMA-208, but can also be a line on range case
- **Range Services Case (Typically not managed by PMA208)**
  - Separate FMS Case to fund target presentation at US Range
  - NCEA
- **Presentations on OCONUS Ranges**
  - Target presentations performed on foreign range
  - France: GQM-163A
  - Normally managed by PMA-208

## FMS Activities

- **Potential FY11/12 LOA requests:**
  - France: GQM-163A follow on case
  - Japan & Germany: GQM-163A
  - Canada, Australia, Japan: BQM-74E/BQM-34S
- **OCONUS FMS deliveries:**
  - FR-P-LGV; 1 GQM-163A sent to France in CY10
- **Typical FMS Range Sites**
  - Pt. Mugu / China Lake, CA
  - PMRF Barking Sands, HI
  - Atlantic Range Facilities, VA



# Target System Challenges

- Keep pace with evolution of threats
  - Electronic emission, vehicle capability, other characteristics
- Develop and field new targets
  - MSST, SSAT, MLT, QF-16
- New capabilities to existing targets
- Evolve target control systems to a more common, government-owned solution across the services
- Manage target production
- Maintain out of production targets
- Support test and training presentations
- Control and reduce cost of acquisition, maintenance, and operations
- Inventory and obsolescence management

A critical enabler to the successful development & fielding of future Naval combatants and their associated defensive weapons systems . . .

***“Just Targets”***



# Questions?

## U.S. Navy Aerial Target Systems

### Contact:

**Captain Dan McNamara**

**Program Manager**

**PMA-208, Navy Aerial Target & Decoy Systems**

**301-757-6129**

**Mr. Tim Barnes**

**Principal Deputy Program Manager**

**PMA-208A, Navy Aerial Target & Decoy Systems**

**301-757-5798**

# Ogden Air Logistics Center 309th Maintenance Wing



**U.S. AIR FORCE**

**309 AMARG**

**Mr. Jeff Peterson**  
**(520) 228-8235**  
**[jeffrey.peterson@dm.af.mil](mailto:jeffrey.peterson@dm.af.mil)**



# 309 AMARG History



*OGDEN AIR LOGISTICS CENTER*



65 year history



Tucson, Arizona selected for

- low humidity,
- firm "caliche" sub-soil supporting the largest of aircraft

1964 SecDef designated Group sole storage, reclamation & disposal mgr.







# 309 AMARG

## Infrastructure

- Industrial Hub (461,293 sq. ft.)
  - Real property buildings - 82
  - Maintenance hangars – 266,000 sq. ft.
  - Warehouse – 156,193 sq. ft.
  - Administrative – 39,100 sq. ft.

- Primary work area . . .  
*the desert*
  - 2,600 acres of land
  - 12 miles of fence line





# Resources



OGDEN AIR LOGISTICS CENTER

- 800+ civilian, military, and contractors
- 2,600 acres storage space
- 460K sq ft industrial space
- Annual revenue of \$122M
- 4,000+ aircraft/6,000+ engines







# AMARG Mission Areas

OGDEN AIR LOGISTICS CENTER

## Aerospace Storage and Preservation



## Aircraft Parts Reclamation



## Depot-Level Maintenance Overflow



## Aircraft Regeneration



## Aircraft Disposal



*Sustaining our Warfighters 24/7*



# Storage & Preservation



OGDEN AIR LOGISTICS CENTER

## ***Five Primary Storage Levels***

- Inviolable – Type 1000 (XS & XT)
- Modified Inviolable – Type 1500
- Parts Reclamation – Type 2000 (XV)
- Flyable Hold – Type 3000 (XS)
- Excess to Single Manager Req'mts – Type 4000





# Parts Reclamation

OGDEN AIR LOGISTICS CENTER

## P-3 Wing Assembly



## Structural Components



## Flight Control Actuator

*Diversity in Parts Reclamation*

*Sustaining our Warfighters 24/7*





# Aircraft Regeneration



OGDEN AIR LOGISTICS CENTER



*Sustaining our Warfighters 24/7*



# Depot-level Maintenance Overflow



OGDEN AIR LOGISTICS CENTER

- A-10 Service Life Extension Program
- A-10 Speedline
- C-130 Program Depot Maintenance



*Sustaining our Warfighters 24/7*



# Aircraft Disposal



OGDEN AIR LOGISTICS CENTER

- Final Defueling
- Assurance Pressure Systems Safe
- Security and Demilitarization of Classified
- Remove/Remediate All Hazardous Materials
- Purging All Halon Serviced Systems
- Engine Dispositions Separate From Aircraft
- Remove Explosive Items/Devices
- Control of Demil/Disposal of Composite Materials



*Protecting the Public From Harmful Exposure*





# AMARG FSAT Program



OGDEN AIR LOGISTICS CENTER

- AMARG Full-Scale Aerial Target Program



- Long-term program
- Began in early 1970's
- F-102, F-100, F-106, F-4, & F-16
- Aircraft regenerated for manned flight
- Drone conversion at BAE Mojave



# AMARG FSAT Program



OGDEN AIR LOGISTICS CENTER

- AMARG Full-Scale Aerial Target Program



## Historic FSAT Deliveries

F-102 - 153





# AMARG FSAT Program



OGDEN AIR LOGISTICS CENTER

- AMARG Full-Scale Aerial Target Program



## Historic FSAT Deliveries

F-102 - 153

F-100 - 312



# AMARG FSAT Program



OGDEN AIR LOGISTICS CENTER

- AMARG Full-Scale Aerial Target Program



## Historic FSAT Deliveries

F-102 - 153

F-100 - 312

F-106 - 184



# AMARG FSAT Program



OGDEN AIR LOGISTICS CENTER

- AMARG Full-Scale Aerial Target Program



## Historic FSAT Deliveries

F-102 - 153

F-100 - 312

F-106 - 184

F-4 - 300 (of 318)



# AMARG FSAT Program



*OGDEN AIR LOGISTICS CENTER*

## ■ Depot Level Support

### ■ SLEP

- FY09 2
- FY10 4
- FY11 2

### ■ DFT

- RF-4C Safe Flights
- Transit Aircraft
- Water Intrusion TCTO
- Damage Repairs





# AMARG FSAT Program

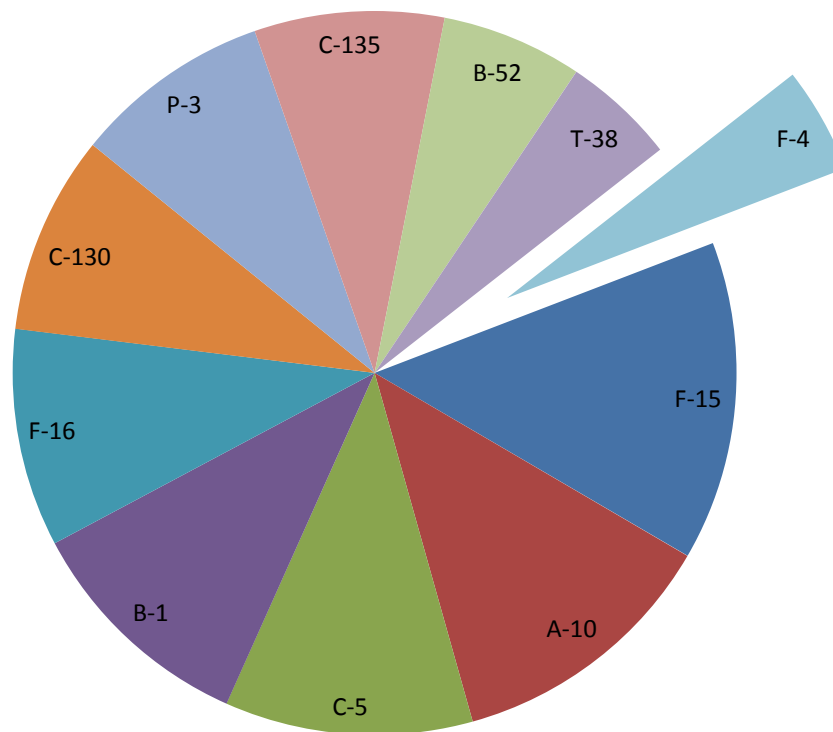


OGDEN AIR LOGISTICS CENTER

## ■ Reclamation Activities

Number of Parts

■ FY 07	484
■ FY08	410
■ FY09	410
■ FY10	641
■ FY11	385







# AMARG FSAT Program



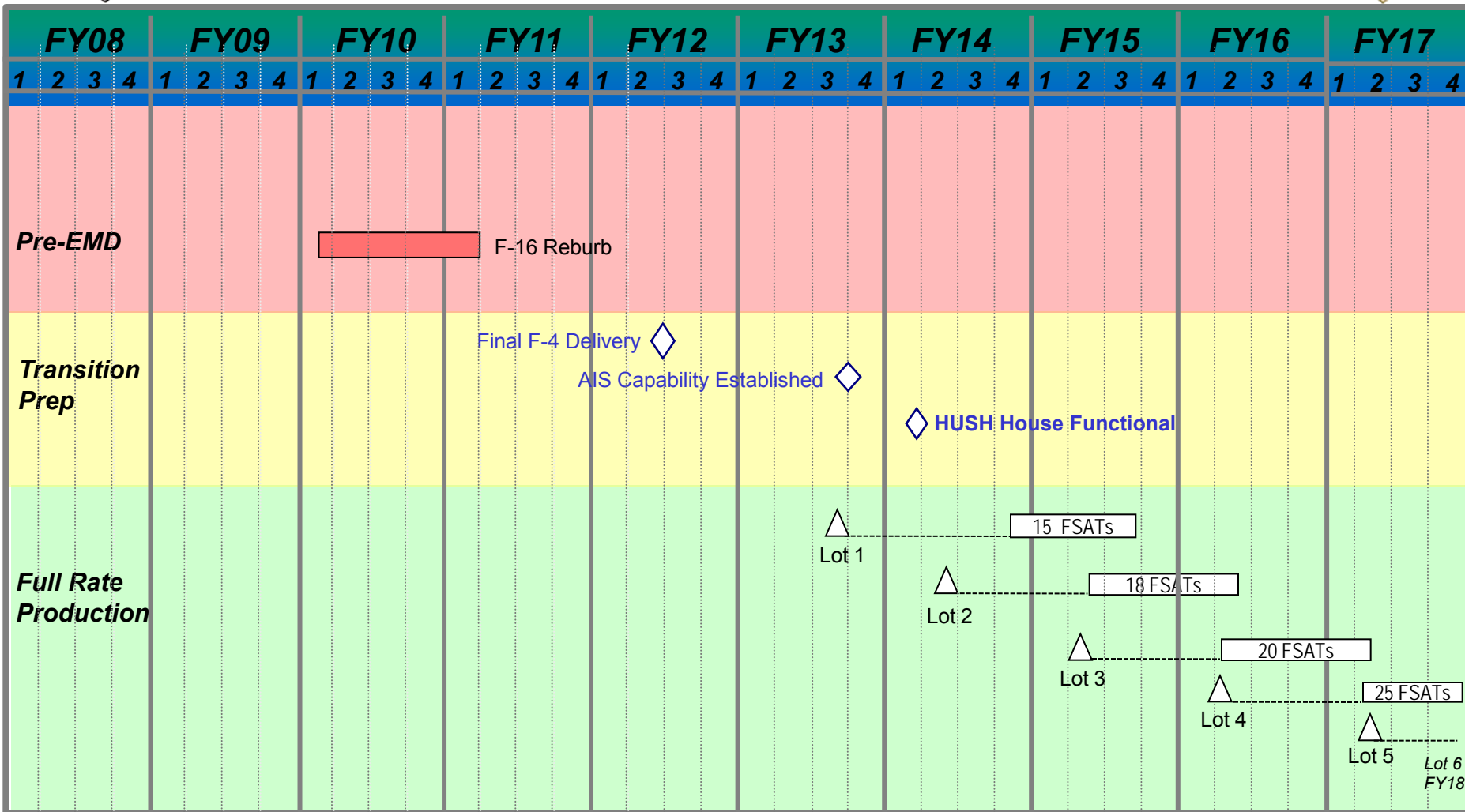
*OGDEN AIR LOGISTICS CENTER*

## F-4 to F-16 Transition





# AMARG QF-16 Program Schedule





# F-16 Engine Re-preservation



*OGDEN AIR LOGISTICS CENTER*

- Long Term desert preservation rqmts changed for F110s from 4 yr to 1 yr cycle
- 83 F100/F110 engines required re-preservation before Oct 11
  - 28/28 engines shipped to CONUS CIRFs
  - 39/55 engines run at DM





# Engine Hush House

OGDEN AIR LOGISTICS CENTER

- **Acquiring Hush House to regenerate QF-16s & represerve F100/F110 engines**
- **Awaiting Air Staff P341 MILCON funding for \$1.9M Hush House concrete pad**
- **Induct 1<sup>st</sup> Aircraft summer 2013**
  - **Open Field run Jun 13 – Jan 14**
  - **Hush house complete Jan 14**





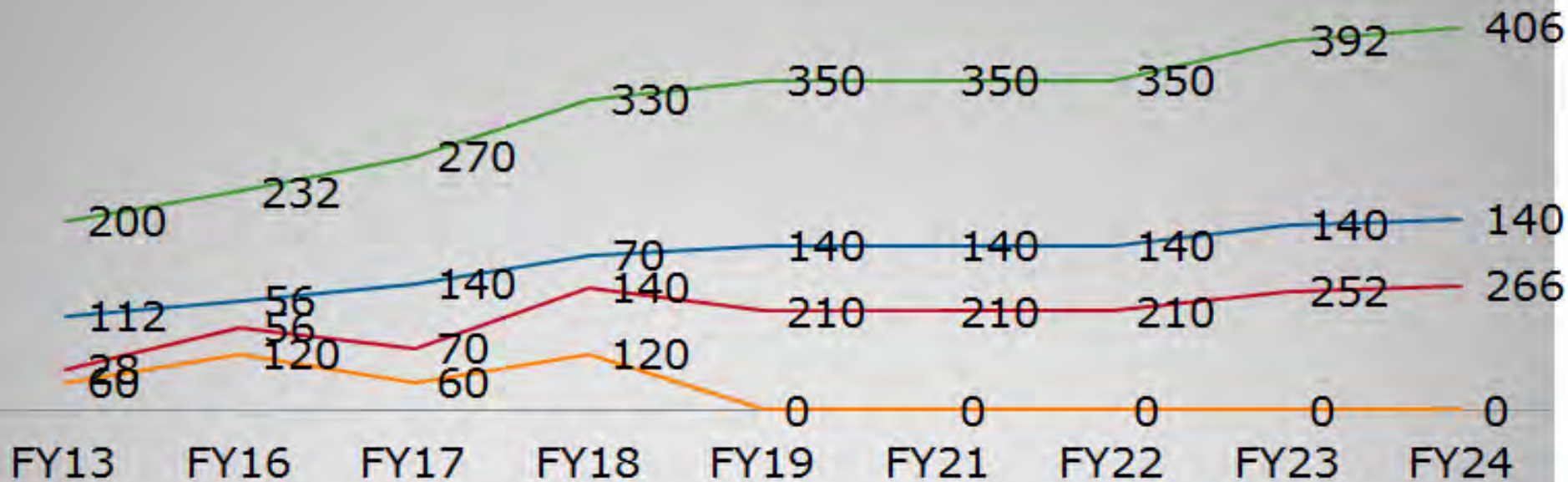
# QF-16 LRU Requirement



OGDEN AIR LOGISTICS CENTER

## Forecast ea FY

— Blk 15 — BLK 25 — BLK 30 — Total







# QF-16 AIS

OGDEN AIR LOGISTICS CENTER

- **Partner with 162<sup>nd</sup> AZNG**
  - QF-16 SPO developing SOW for 162<sup>nd</sup> to sustain first 2 yrs
  - Transition to organic capability by FY14
  
- **Bid/Award Contract for Turnkey operation**
  - Equipment install and hook up (Aug 12)
  - Training (Nov 12 – Jul 13)
  - Sustain organic workload FY14





# AMARG Vision

OGDEN AIR LOGISTICS CENTER

*"To be the most admired logistics enterprise providing agile and efficient, world-class depot-level maintenance & logistics support."*



*...Sustaining our Warfighters 24/7*

# Questions?







UNITED STATES AIR FORCE



# ***Air Force Aerial Targets***

***October 2011 NDIA Brief***

***Fort Walton Beach, FL***

***Ms. Holly Reedy***

***Chief, Full-Scale Targets***

***Aerial Targets Branch (AAC/EBYA)***

***Eglin AFB, FL***



# Overview



- **System Description**
- Organizational Structure
- Product Groups
  - Subscale Aerial Targets
  - Full-Scale Aerial Targets
  - Target Control Systems (TCS)
- Summary

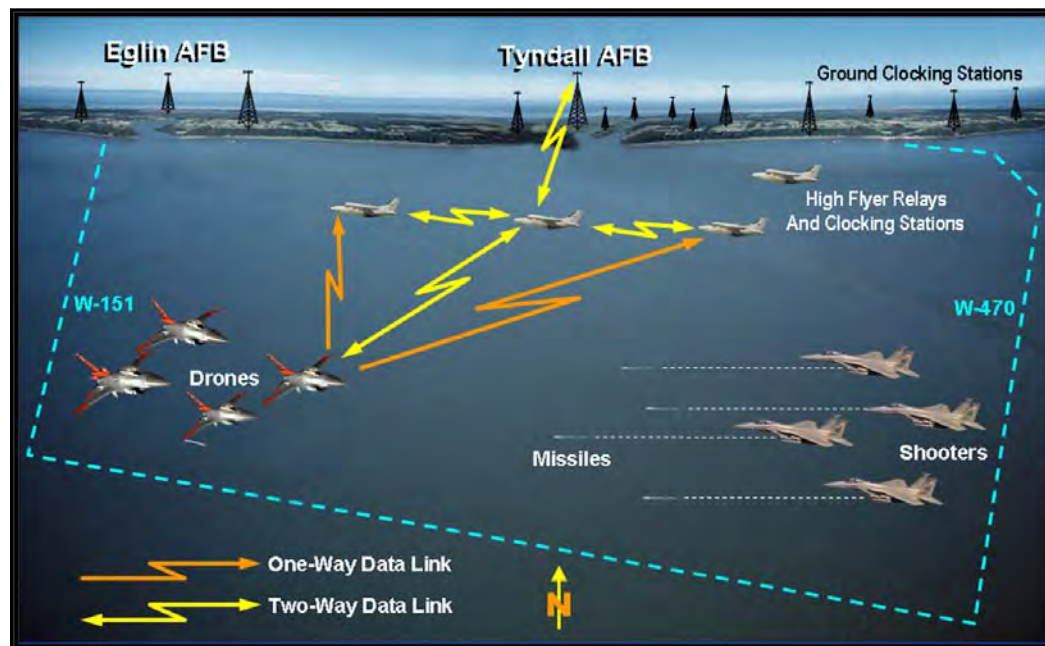




# Targets Operations



- **Provide “Presentations” of Realistic Threat Representative Systems in Support of Joint Requirements:**
  - Lethality Testing Required for New or Improved Weapon Systems Prior to Production (10 USC 2366)
  - USAF Air-to-Air Weapon System Evaluation Program
- **Validate Performance of DoD Air-to-Air Missiles and Aircraft Systems**
  - Emulates Performance, Signatures and Countermeasures (Infrared and Electronic Attack)



## Aerial Target “Presentations” Include:

- The Target Itself
- Threat Representative EA/IR Payloads
- Target Control System (TCS)
- Missile Scoring
- Launch, Recovery, Maintenance & Repair of Target



# Overview



- System Description
- **Organizational Structure**
- Product Groups
  - Subscale Aerial Targets
  - Full-Scale Aerial Targets
  - Target Control Systems (TCS)
- Summary



# Aerial Targets Branch (AAC/EBYA)



Air Force  
Headquarters

Air Force  
Materiel Command

Air Armament  
Center

Armament Directorate  
(AAC/EB)

Test and Training Division  
(AAC/EBY)

Aerial Targets Branch  
AAC/EBYA

**Maj Gen Kenneth D. Merchant, Commander**

**Mr. Randy Brown, Director  
Armament Directorate**

**Lt Col Patrick, Acting Materiel Leader  
Test and Training Systems Program Manager**

**Mr. Michael VandenBoom, Materiel Leader  
Aerial Targets Program Manager**



**Mr. Michael VandenBoom**  
Materiel Leader



**Mr. Dave Osborn**  
Chief, Logistics



**Mr. Jim Cornwell**  
Chief, Subscale Targets,  
Target Control System



**Ms. Holly Reedy**  
Chief, Full-Scale Targets  
Section



**Ms. Tammy Robbins**  
Chief, FM



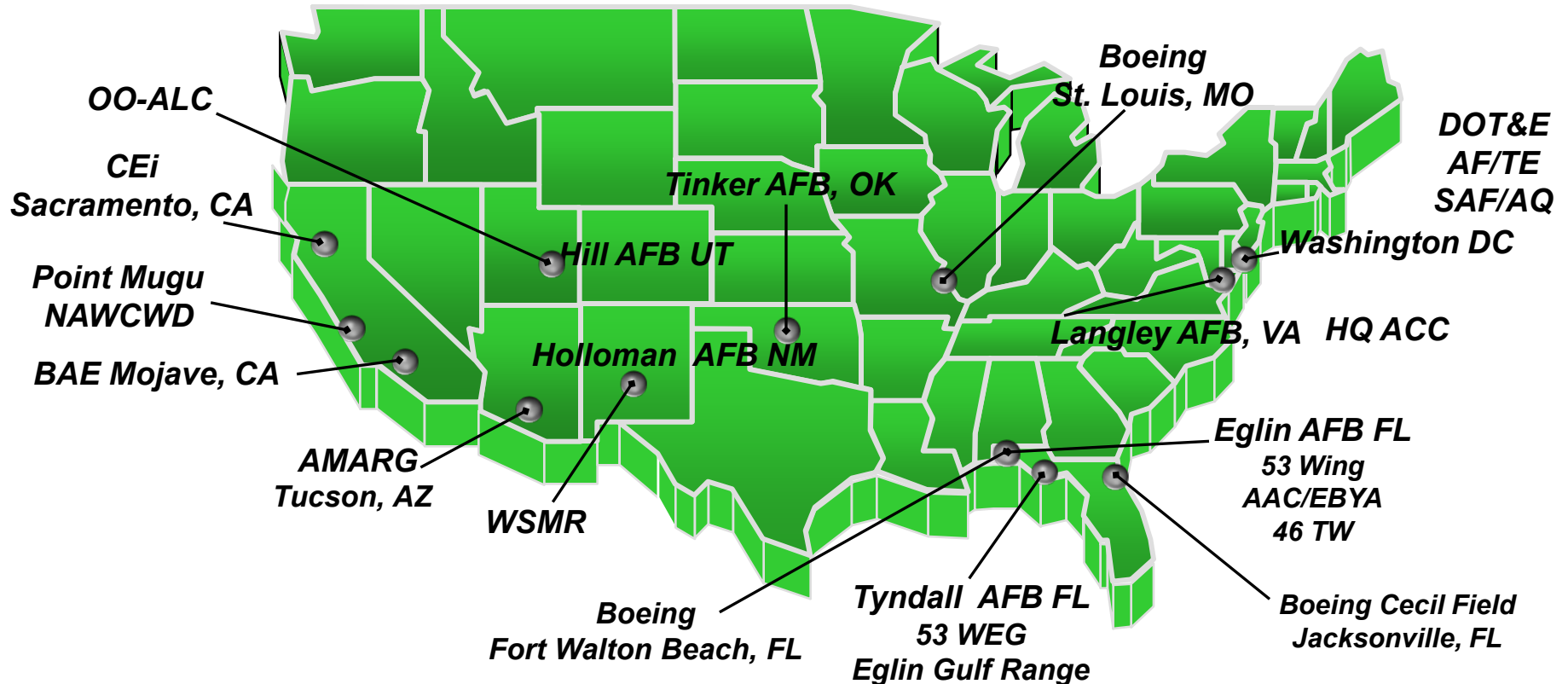
**Ms. Cheryl Junkers**  
Chief, Contracting



**Mr. Greg Pixley**  
Chief Engineer

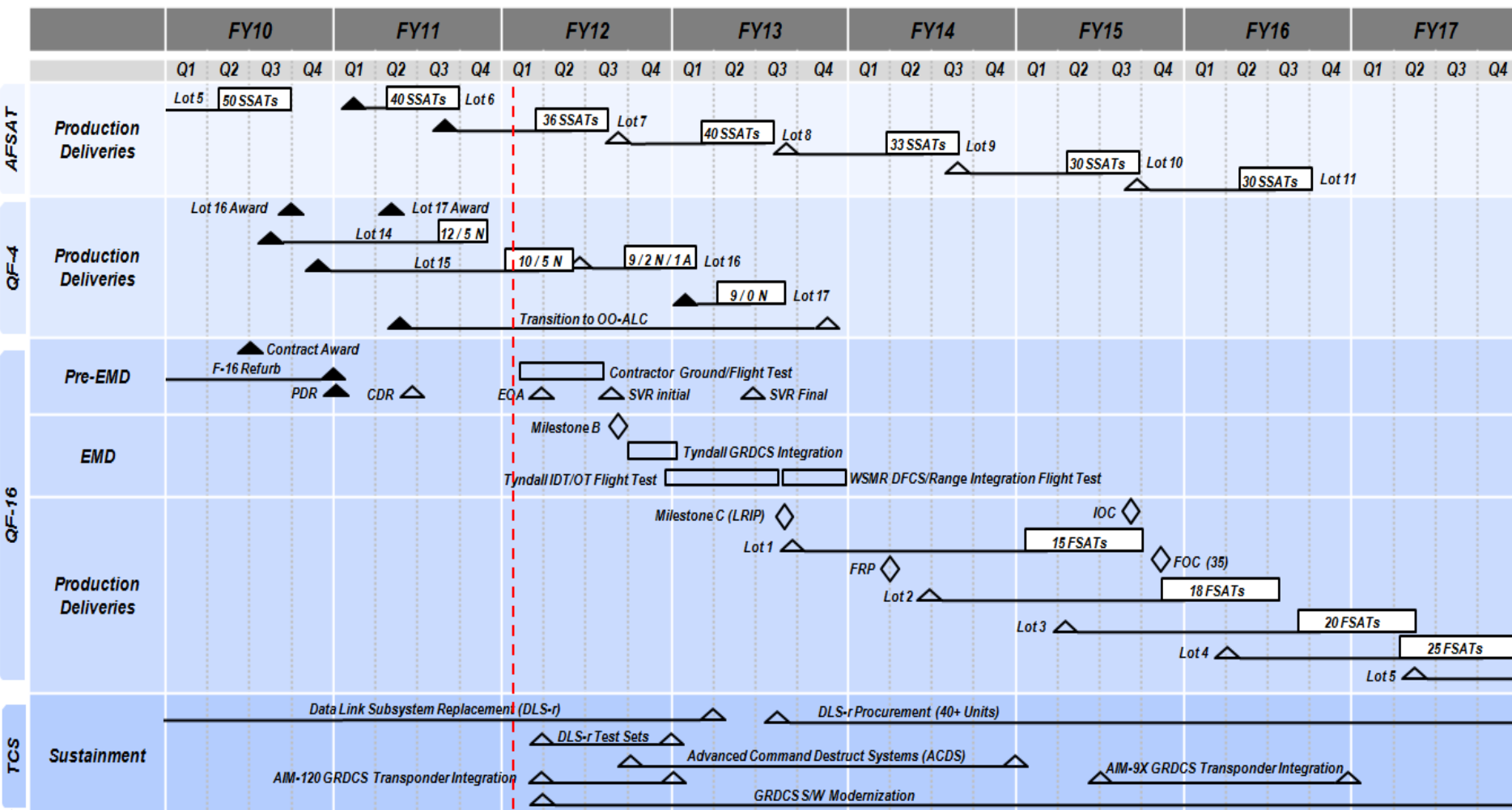


# USAF Aerial Targets Stakeholders





# Program Schedules







# Overview



- System Description
- Organizational Structure
- **Product Groups**
  - Subscale Aerial Targets
  - Full-Scale Aerial Targets
  - Target Control Systems (TCS)
- Summary



# ***AFSAT Subscale Aerial Target***

*Jim Cornwell, Program Manager (Acting)*



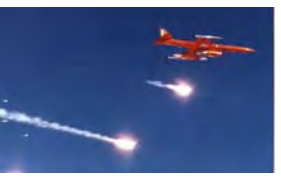
***Prime Contractor: Composite Engineering, Inc. (CEi)***

***ACAT III***

***Contract Type: FFP***

***Description:***

- **An Affordable, All-Composite Airframe**
- **Flies Faster/Slower, Higher/Lower, and Provides 3x+ More Presentations Than Legacy Subscale Targets**
- **Program in Production Phase**
- **Operates via Ground Based Target Control System**
- **Subsonic, Relatively Heavy Payload Capability**





# AFSAT FY11 Accomplishments



- **Current Program Focus**
  - Sustainment Planning Through 2020
- **Awarded Lot 8 Productions**
  - 224 Targets Delivered to Date
  - 2 Lots (Lots 9 & 10); Final Lots Under Current Contract
- **196 WEG Operational “Hot” Missions Supported Since Fielding**

	<u><i>FY11</i></u>	<u><i>Since Fielding (FY08)</i></u>
<b>Launches</b>	<b>127</b>	<b>412</b>
<b>Presentations</b>	<b>448</b>	<b>1502</b>
<b>Missile Shots</b>	<b>462</b>	<b>1259</b>

- **LRS Deliveries Set For 2QFY13 (6 Tyndall; 3 UTTR)**



# ***FY12 Road Ahead***



- **Continuing Production**
  - Lot 9 Award Jan 2012
  - Acquisition Planning for Follow-On Production Contract
- **Fielding of New Launch Rail Systems**
- **Product Improvement Activities**
  - Completion of IEA Development and Testing
  - Completion of SIRS Blocks 3/4 Development and Testing
  - Development of RCS Pods



# Overview



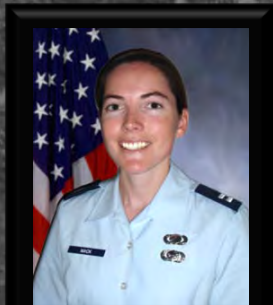
- System Description
- Organizational Structure
- **Product Groups**
  - Subscale Aerial Targets
  - Full-Scale Aerial Targets
  - Target Control Systems (TCS)
- Summary





# ***QF-4 Full-Scale Aerial Target***

***Capt Briana Mack, Program Manager***



***Prime Contractor: BAE Systems, CA***

***ACAT III***

***Contract Type: FFP***

## ***Description:***

- **Full-Scale Aerial Target for Threat- Representative Weapon System Evaluation**
- **Meets USAF, USA, USN, Allied Test Requirements**
- **Droned, Refurbished F-4 Aircraft Out of AMARG**
- **Program in Full Rate Production**
- **Operates via Ground-Based Target Control System**
- **Supersonic, High-G, Heavy Payload Capability**
- **Provides 3rd Generation Threat Representation**





# ***QF-4 2011 Accomplishments***



- **Key Focus – Bridging the Gap Until QF-16 IOC**
  - Completing Production Lots 15 -17
  - Sustainment Planning Through 2017
- **Awarded Last Production Lot (Lot 17) Feb 11**
  - Total of 289 QF-4s Delivered to Date
- **FY11 Operations**
  - 1102 Missions
  - 15 NULLO
  - 8 Kills



# ***End of Program Challenges***



- **Regen/Repair Challenges With Older QRF-4C Aircraft**
- **Post Production Planning**
  - Production Deliveries Complete 4QFY13
  - Sustainment Support in Place
  - Post Production CLINs for EN/LG Reach-back
- **QF-4 Transition to OO-ALC**
  - DSM Function Complete After Last Production 4QFY13
  - Transition Execution 1QFY14



# ***QF-16 Full-Scale Aerial Target***

***Mr. Kenneth Hislop, Program Manager***



***Prime Contractor: Boeing Company, St. Louis, MO***

***ACAT: II***

***Contract Type: FPIF / FFP***

## ***Description***

- **Next Generation Full-Scale Target for Threat-Representative Testing & Weapon System Evaluation**
- **Provides 4th Generation Threat Representation**
- **Meets USAF, USA, USN, Allied Test Requirements**
- **Refurbished F-16 Aircraft With Drone Mod Installed**
- **Supersonic, High-G, Heavy Payload Capability**
- **Operations Via Ground Based Target Control System**







# QF-16 Program Snapshot



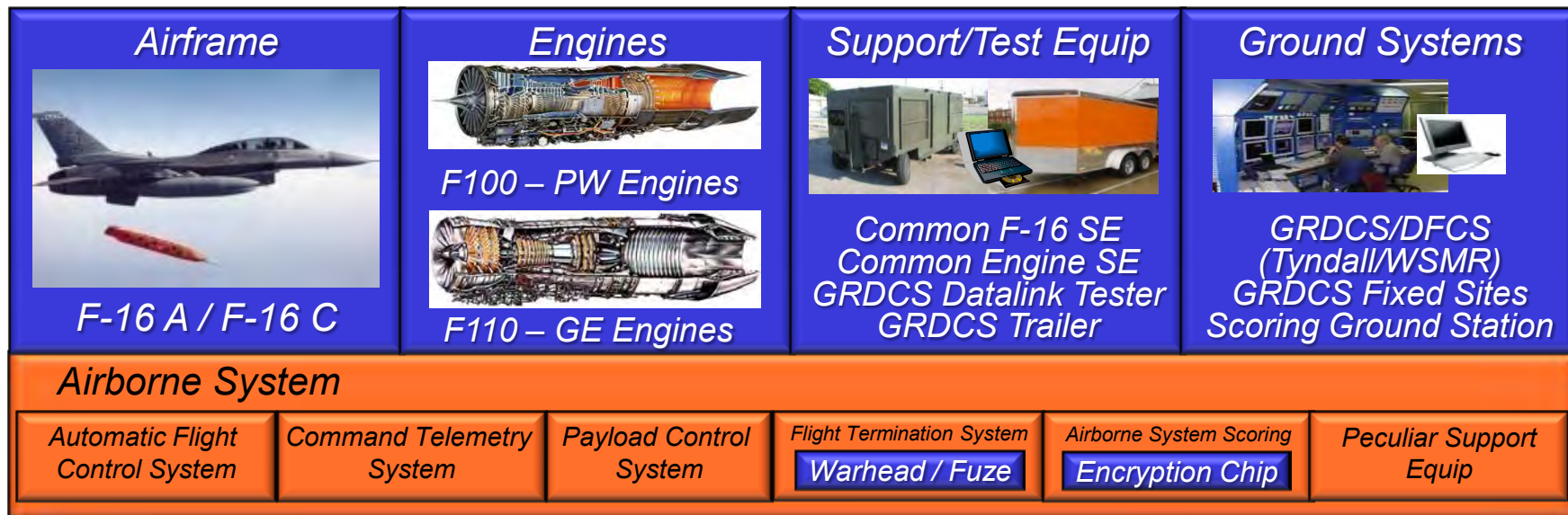
- **Production Quantity - 210 QF-16s (AF Only)**
- **DT/OT Oversight Program**
- **Upcoming Program Milestones:**
  - First A/C Mod Complete - 1Q FY12
  - Flight Testing - 2Q FY12
  - Milestone B - 3Q FY12
  - Milestone C - 3Q FY13
  - IOC - 3Q FY15
  - FOC - 2Q FY16







# QF-16 System Integration



Government Furnished  
(67% of \$)



Contractor Developed  
(33% of \$)



QF-16 System Integration:  
Contractor Drone Peculiar Equipment w/ GFP

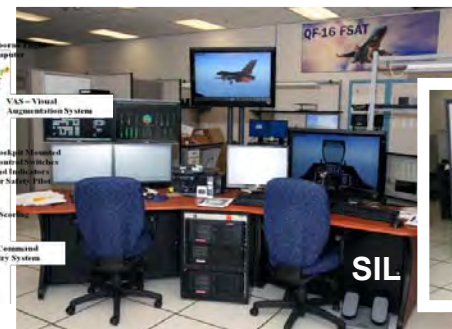
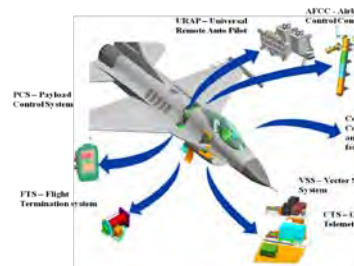
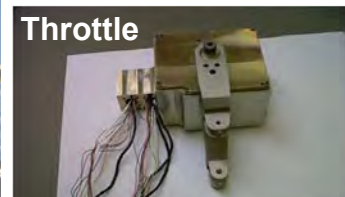
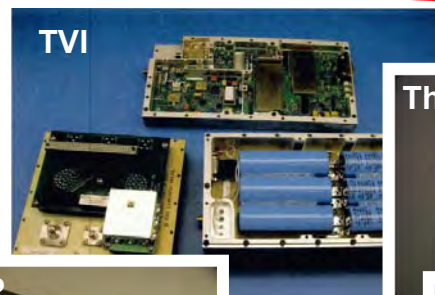


# DPE Development



## • Boeing DPE Hardware

- Automatic Flight Control Computer (AFCC)
- Transponder Vehicle Interface (TVI)
- Autothrottle
- Universal Replacement Auto Pilot (URAP)
- Vector Scoring System
- Visual Augmentation System (VAS)
- Backup Radar Altimeter
- FTS Components





# GFP Program

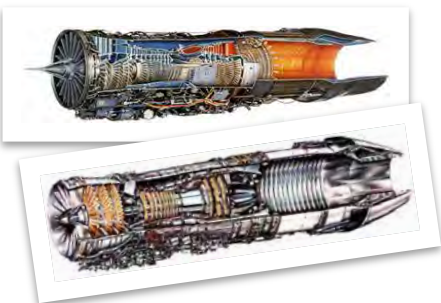
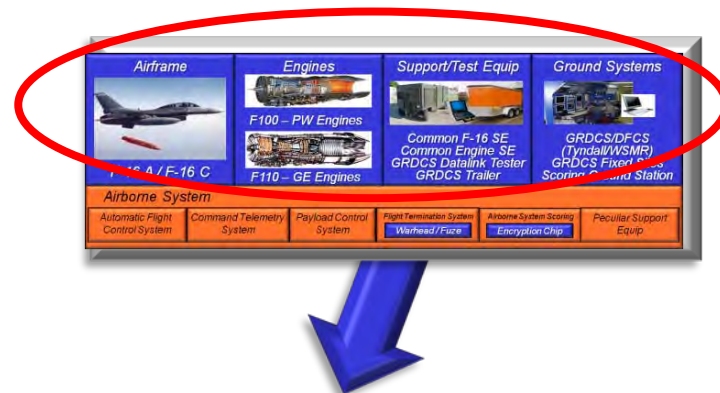


## AIRCRAFT - Block 15/25/30

- ALL Aircraft Regenerated for MANNED flight (~300 hrs)

## ENGINES

- Engines – 3 Configurations
  - F100-PW-220 (MANNED)
  - F100-PW-200D (UNMANNED)
  - F110-GE-100B (MANNED/UNMANNED)
- Minimum 600 (PW)/900 (GE) Cycles for MANNED



## SUPPORT EQUIPMENT

- Required at Cecil, AMARG, Tyndall, Holloman

## TARGET CONTROL SYSTEM INTEGRATION

- Emulator
- Trailer/Towers
- DataLink Tester







# QF-16 Production



F-16  
Records  
Review

## REGENERATE F-16

Induct -1000 Stored F-16 in  
AMARG Production Line



## Engine Refurb

Refurb F100-PW &  
F110-GE Engines at  
JEIM/CIRFs for  
Delivery to AMARG

- Edwards AFB
- Tucson, AZ 162<sup>nd</sup> ANG
- New Orleans, LA ANG
- Springfield, IL ANG

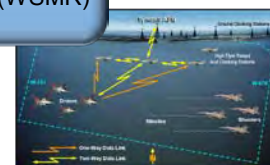
## DPE Installation

Boeing Install Drone  
Package at Cecil Field, FL  
GFP Repair (O&A)



## Drone Operations

Tyndall AFB, FL (EGTTR)  
Holloman AFB, NM (WSMR)





# QF-16 Program Status



- All Six Regen Pre-EMD A/C Delivered to Cecil Field
- First Drone Mod Started Sep 11
- Concurrent Subsystem Qual Tests Underway
- Tackling Airworthiness Certification Challenges
- QF-16 Testing Activities
  - QF-16 Ground Test 1QFY12
  - QF-16 Flight Test 2QFY12
- Capturing Lessons Learned from EMD Regen Efforts
- Standing Up AMARG/Engine Depots for Production



*First Pre-EMD Jet Delivery To Cecil Field*





# Overview



- System Description
- Organizational Structure
- **Product Groups**
  - Subscale Aerial Targets
  - Full-Scale Aerial Targets
  - Target Control Systems (TCS)
- Summary



# Target Control System (TCS)

*Ms. Kathy Fuszner, TCS Program Manager*

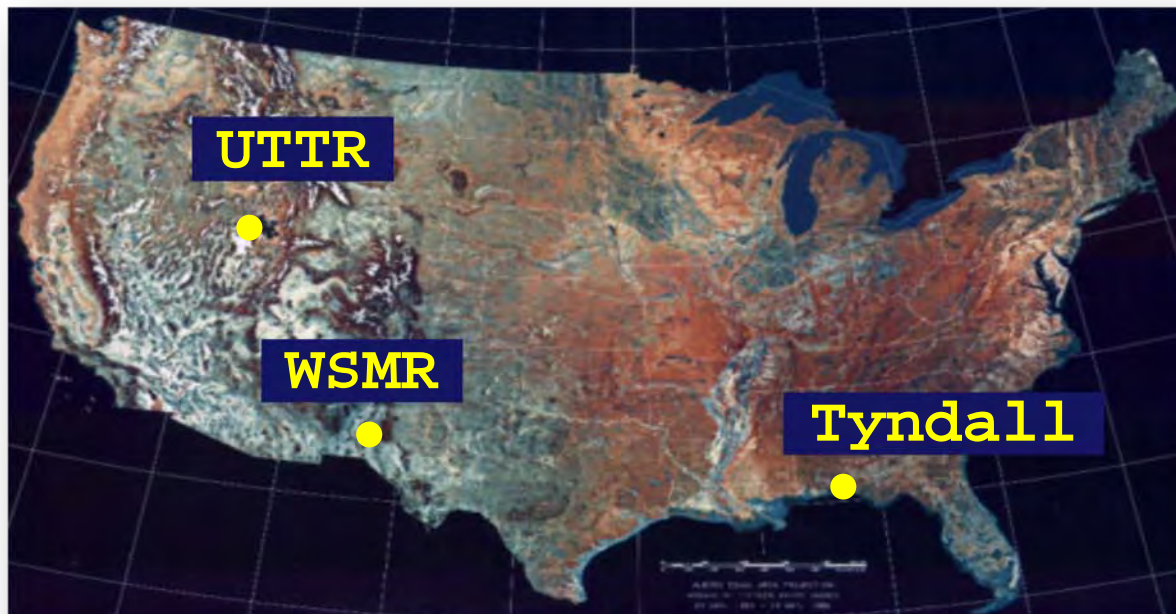


## *Description*

- Tracks/controls 4 targets & 10 aircraft/missiles
- Provides command destruct of targets and missiles
- Compatible with QF-4, AFSAT (QF-16 integration ongoing)
- System developed by 46th TW, operated by 53d WEG



# Ranges



## ***Tyndall AFB / Eglin AFB***

- Main Mission Ops (53 WEG)
- GRDCS Sustainment & Dev (46 TW)
- Target & Target Control Acq (AAC/EBYA)

## ***Holloman AFB / WSMR, NM***

- Support FSAT Ops (53 DET)  
Utilizing Drone Formation  
Control System (DFCS) at  
White Sands

## ***Utah Test & Training***

- Support Combined Combat  
Archer and Combat Hammer  
Evaluation (53 WEG)



# DLS-r



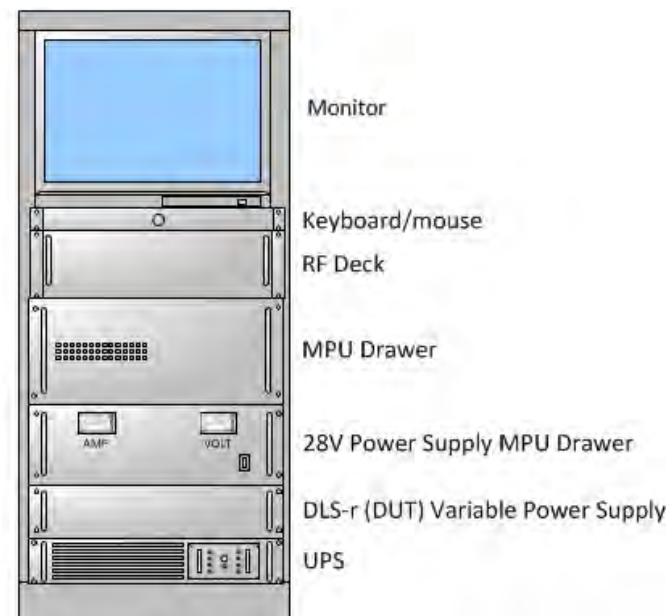
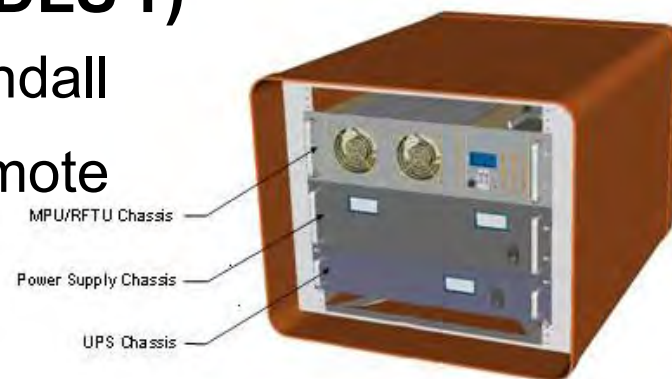
- **Data Link System Replacement (DLS-r)**

- Replace unsustainable DLSs at Tyndall
- Provide data communication for remote drone operations
- Development Ongoing (14)
- Test/Integration FY12
- Follow-On Procurement FY14

- **DLS-r Interim Test Set (IACS-III)**

## 46 TW (Bldg 22)

- Pt. Mugu
- Eglin/Tyndall







# Current GRDCS Efforts



## Data Link System Replacement (DLS-r)

- Provides Data Relay for Remote Drone Ops
- Replacement Reduces Risk for Tst/Trng Programs

DLS-r



DLS



## GRDCS Display Upgrades

- Replacing Obsolete Propriety Systems w/ Open Standards
- Modern Technology Display



## Platform Specific Efforts

- Software Updates & Integration



## Mobile GRDCS Trailer/Towers



- GRDCS Capability at Cecil Filed for Contractor Ground/Flight Test
- Remains at Cecil for Production



## Other GRDCS Sustainment

- Technology Refresh
- GRDCS Tech Data Package (Drawings / Manuals)







# ***Future Features***



- **Insert TCS Interface Standards**
  - DLI (Data Link Interface)
  - VCI (Vehicle Control Interface)
- **Consider Other Scoring Technologies**
- **Software Modernization**
  - Migrate Control Processors to Linux Servers
  - Decoupled Simulation to Standalone Processor
  - Enhance System Startup and Configuration to Point/Click Interface
  - Enhanced Logging, Record More Data
  - Real-time Matlab® Analysis Capability
  - Integrate GRDCS Transponder for AIM-120



# Overview



- System Description
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# Summary



- **AFSAT Workhorse for Warfighter**
  - Supported 67 Operational Missions in FY11
  - Next Step: Award Lot 9 in FY12
- **QF-4 Production Planned Through FY13**
  - Program Transition to Logistics Center for Sustainment
  - Planning for Availability Through 2017
- **QF-16 Preparing for Contractor Test**
  - First Production Delivery Late FY14
- **TCS**
  - Modernization Underway
  - Backbone for Target Platforms





### ***Purpose:***

**Provide NDIA Symposium An Overview Of  
U.S. Army, PEO STRI, PM ITTS  
TMO Activities**

**Briefed by:**

**Mr. Bruce Truog**

**TMO Deputy Director, PMITTS, PEO STRI**

**256-842-6421 DSN: 788-6421**

**e-mail: [bruce.truog@us.army.mil](mailto:bruce.truog@us.army.mil)**





## ***FALSE IMPRESSION CAVEAT***



It should be explicitly noted that the U.S. Government makes no official commitment nor obligation to provide any additional detailed information or an agreement of sale on any of the systems/capabilities portrayed during this presentation that have not been authorized for release.



# ***OUTLINE***



- **Who We Are**
- **Mission**
- **Activities**
- **Organization (Tie-in with Testing & Training)**
- **Recently Developed Products**
- **Future Efforts**
- **Summary**

# ORGANIZATION

## PM ITTS

**PM: COL Michael E. Zarbo**  
**Project Manager for Instrumentation, Targets,**  
**and Threat Simulators**

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**12350 Research Parkway, Orlando, FL 32826-3276**  
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**email: michael.zarbo@us.army.mil**  
**DPM: Mr. Jerry Sirmans**  
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**DSN 746-8700**  
**e-mail:**  
**timothy.bishop@us.army.mil**



Visit our website at <http://www.peostri.army.mil/PM-ITTS>



## ***TMO MISSION***



- **MANAGE TOTAL LIFE CYCLE OF TARGETS, OPERATIONAL THREAT VEHICLES, TARGET CONTROL SYSTEMS AND GROUND RANGE SYSTEMS USED IN LIVE AND VIRTUAL TESTING, AND TRAINING.**
- **PROVIDE BEST VALUE ACQUISITION, SUPERIOR LIFE CYCLE SUSTAINMENT AND OPERATION FOR THE U.S. ARMY, DoD AND INTERNATIONAL CUSTOMER.**
- **EXECUTE MISSIONS AS ASSIGNED OR DIRECTED BY PEO STRI AND PM ITTS.**





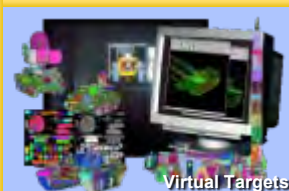
# PRIMARY ACTIVITIES

## Based on Customer Target Requirements

- Aerial – Fixed and Rotary Wing
- Mobile Ground / Foreign Materiel (both conventional and unconventional)
  - “Real Deal Steel”
  - Surrogates
- Virtual – Models and Simulations
- Precision Targetry Systems
- Auxiliary / Ancillary Equipment



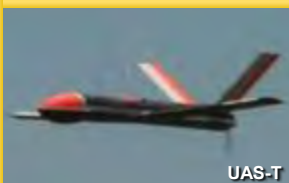
MQM-107



Virtual Targets



Precision Targetry System



UAS-T



BTR-80



QUH-1



T-72



Technical Vehicle



Towed Target



MSAT



BMP-2



RPVT

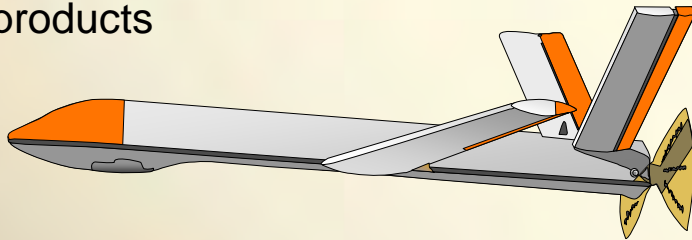




# WHAT WE DO



Develop  
products



Buy products



AND we



Fly



Drive



Sustain



# AERIAL TARGETS



Remote Piloted Vehicle Target



- Turnkey Operations
- Target systems flight services supporting Army and Tri-service test and training and FMS requirements
- Low Cost

Towed Targets



\*Aerial Target Flight Services

Simulate Aerial Threats World-Wide in Live and Virtual Domains





# MOBILE GROUND TARGETS



## Centrally Manage and Execute:

- 250 active assets
- Mobile Ground Targets for development and operational testing
- Multiple usage options:
  - Rent
  - Lease
  - Buy
- Provide accreditation support

## Range Targetry

- Design
- Procurement
- Fielding
- Support



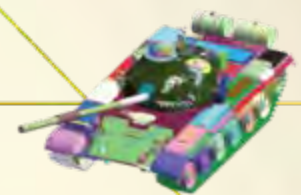
Threat Representative Targets in Live and Virtual Domains



# VIRTUAL TARGETS



- **Virtual Targets Project:** Building simulation target models capable of being used in synthetic signature prediction analysis software programs
- **Target Generation Laboratory:** Transitioning CAD models into simulation compliant visual, infrared, and radar frequency simulation target models
- **Army Model Exchange:** Distributing simulation target models to simulation developers throughout the Army T&E community







# ***WHAT WE HAVE DEVELOPED/ PURCHASED RECENTLY***

## **Precision Target Signature**

**ZSU-23-4**



**BMP-3**



**T-72**



**Boomer**



**Virtual Targets**



**BTR-80**





# FIVE YEAR FORECAST TO DEVELOP/PURCHASE

Precision Targets –  
Mobility/RCS



Medium Speed Aerial Targets



High Speed Aerial Targets



Mannequin IR



SCUD-B Virtual Target



Fully Mission Capable  
Threat Targets



Technical Vehicle w/crew  
representation



Common Control System



## ***SUMMARY***



### ***TMO:***

- **ALWAYS LOOKING FOR A BETTER, FASTER, CHEAPER PRODUCT FOR OUR CUSTOMERS**
- **RECOGNIZED LEADER OF AERIAL AND GROUND TARGETS**
- **READY TO RESPONSIVELY AND RESPONSIBLY SUPPORT T&E AND SPECIAL TRAINING REQUIREMENTS**

**NEED INDUSTRY TO CONTINUE PROVIDING STATE OF THE ART TECHNOLOGIES FOR ADAPTATION AND INCORPORATION INTO TARGETRY**





# ***PROVIDING/OPERATING AERIAL, GROUND & VIRTUAL TARGETS***

AERIAL TARGETS



VIRTUAL TARGETS

GROUND TARGETS





*OSD VISION FORWARD FOR*  
**Unmanned Aircraft  
Roadmap**

**Mr. Dyke Weatherington**  
**OUUSD(AT&L)/S&TS**  
**Director, Unmanned Warfare**



Cleared for Open Publication  
11-S-1201

**NDIA Oct 27<sup>th</sup> 2011**







# Overview



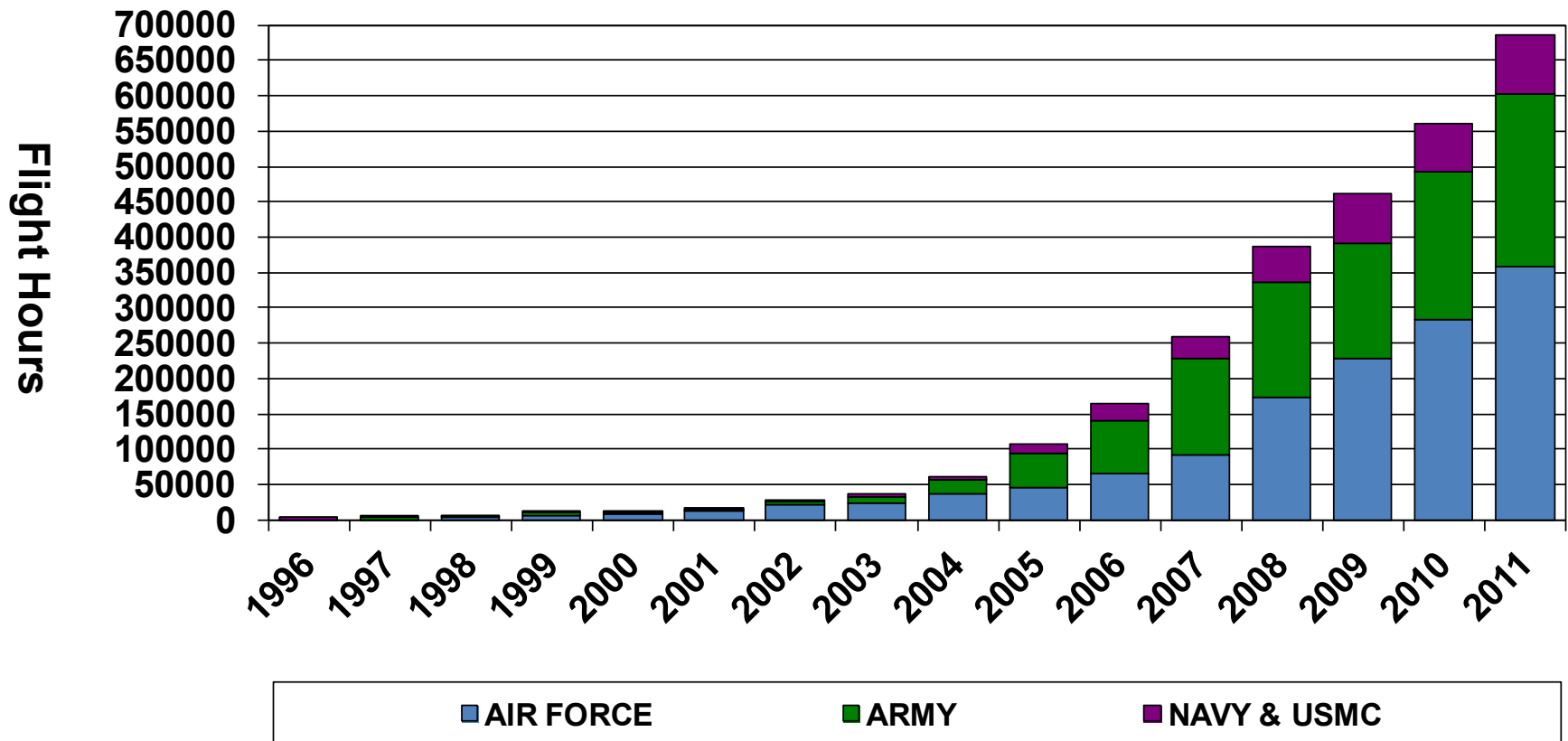
- Current UAS Status
- Acquisition Challenges
- Vision and Roadmap
  - Interoperability
  - Airspace Integration
  - Unmanned Systems Roadmap
- Summary







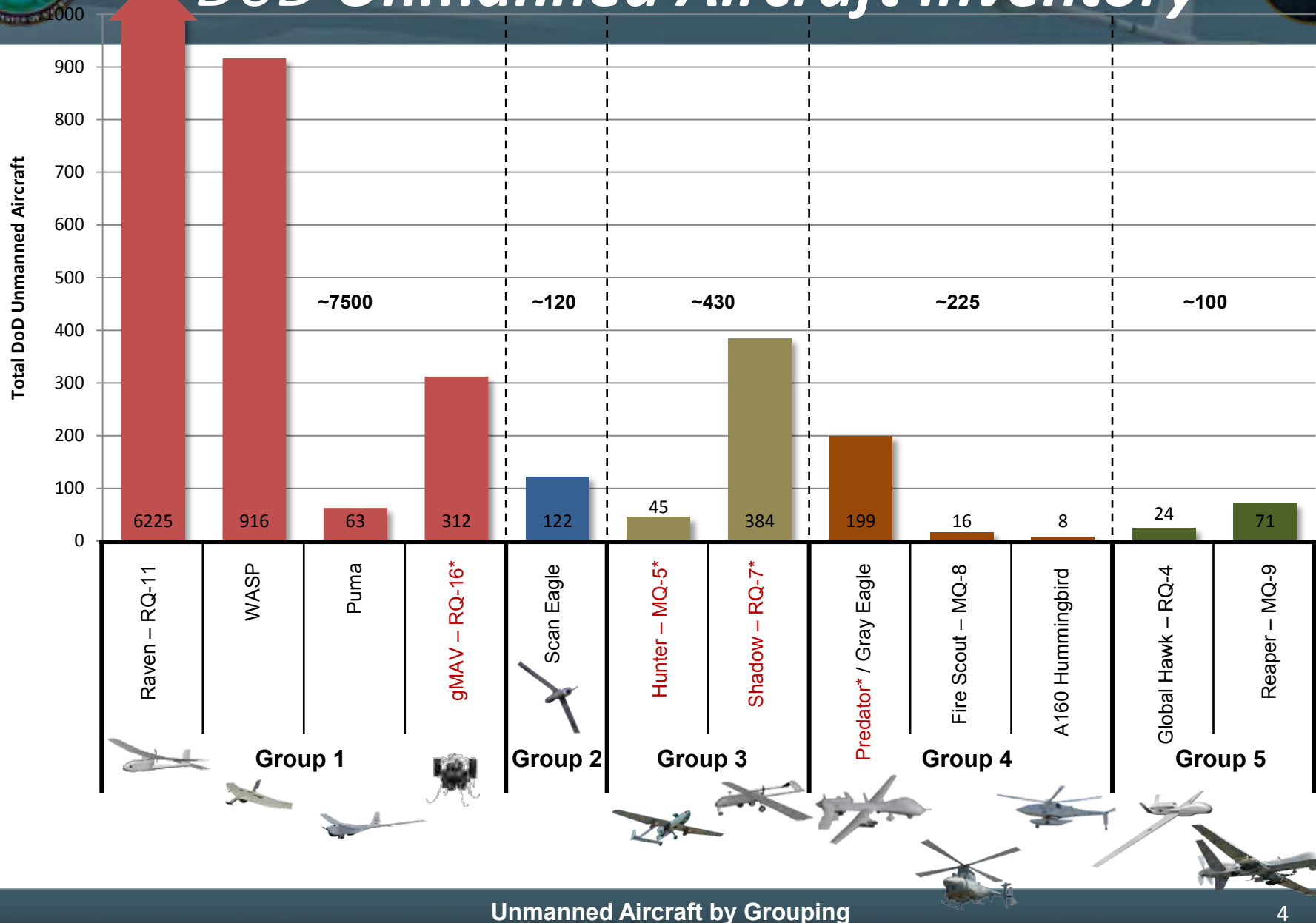
# DoD UAS Flight Hours (By Department, By Fiscal Year)



Does not include Group 1 UAS



# DoD Unmanned Aircraft Inventory





# DoD Acquisition Challenges

- **Acquisition Efficiencies & Affordability**
- **Interoperability**
- **Airspace Access**
- **Frequency Spectrum**
- **Cost Control**
- **Acquisition Performance**
- **Technology Transition**
- **Sustainment Planning**
- **Open Business Model**

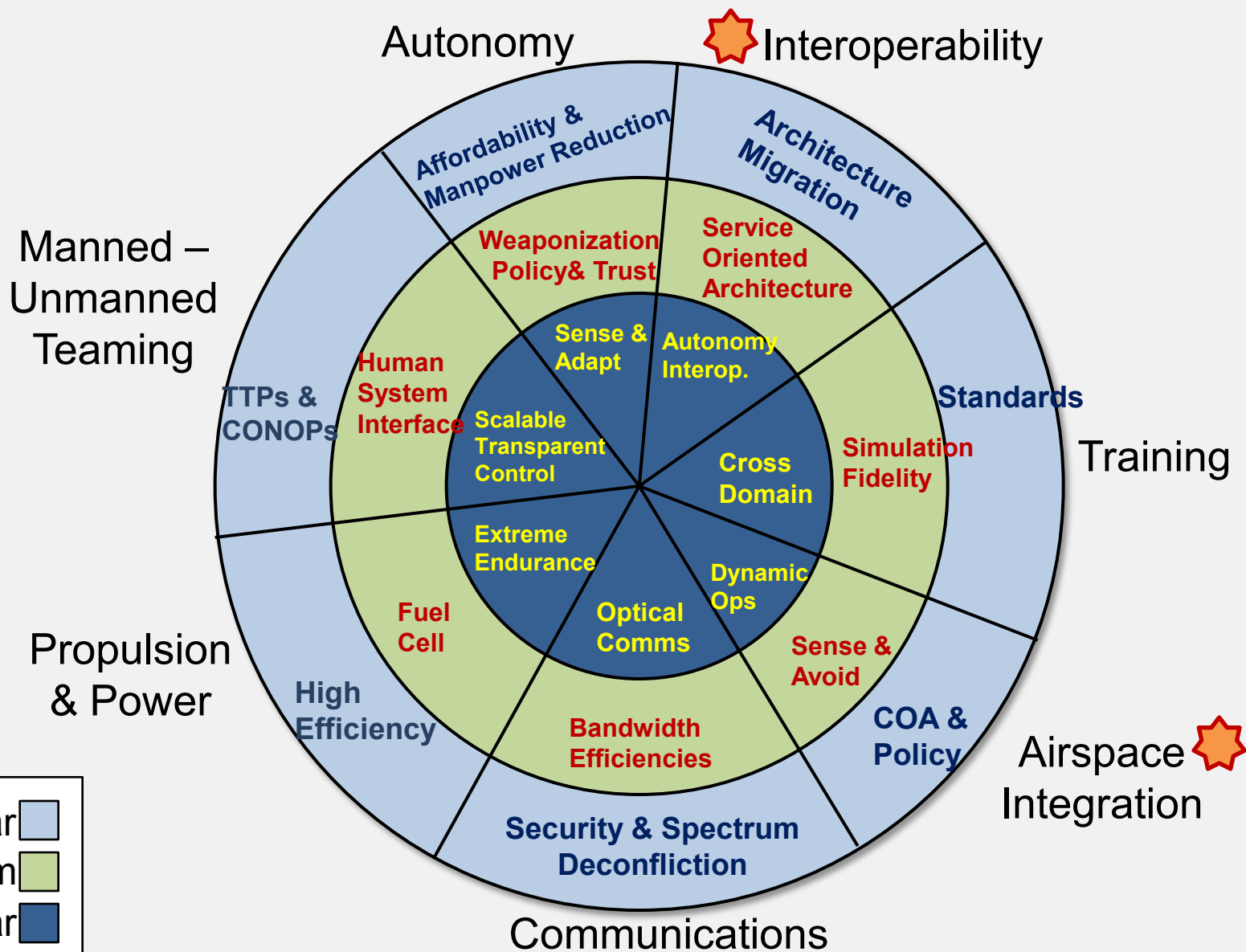
## Reuse versus Start New

Our program managers should be scrutinizing every element of program costs, assessing whether each element can be reduced relative to the year before, challenging learning curves, dissecting overheads and indirect costs, and targeting cost reduction with profit incentives - in short, executing to what the program should cost.



# Meeting the Challenges

## Unmanned System Roadmap





# Introduction/Vision

**Vision:** Seamless integration of diverse unmanned capabilities that provide flexible options for Joint Warfighters while exploiting the inherent advantages of unmanned technologies, including persistence, size, speed, maneuverability, and reduced risk to human life. DoD envisions unmanned systems seamlessly operating with manned systems while gradually reducing the degree of human control and decision making required for the unmanned portion of the force structure.



UNMANNED WARFARE INFORMATION REPOSITORY  
Office of the Under Secretary of Defense for Acquisitions, Technology and Logistics

UAS Task Force | Roadmap | Integrated Catalog | Summary Charts | References

### Integrated Catalog

Contract All | Expand All

System	Lead Service	Capabilities	ACAT	Acq. Phase
<b>AIR SYSTEMS</b>				
<b>GROUP 1 ~~~~~ 6-20 LBS, &lt;1,200 AGL, &lt;100 KIAS</b>				
RQ-158 T-Hawk	US Navy	ISR/RSTA, EOD	Non-ACAT	Other
Wasp	US Air Force	ISR/RSTA	Non-ACAT	Other
RQ-119 Raven	US Army	ISR/RSTA	IVIT	Other
AFCV BJAS (Puma AE)	US SOCOM	ISR/RSTA, FP	III	MS-C
<b>GROUP 2 ~~~~~ 21-55 LBS, &lt;3,500 AGL, &lt;250 KIAS</b>				
Sober Eagle	US Navy, US Marines	ISR/RSTA, Force Protection	Non-ACAT	Other
<b>GROUP 3 ~~~~~ &lt;1,320 LBS, &lt;18,000 MSL, &lt;250 KIAS</b>				
MQ-56 Hunter	US Army	ISR/RSTA, EW, Force Protection		Sustainment
RQ-7B Shadow	US Army	ISR/RSTA, C3, Force Protection	II	Peak, MS-C
RQ-21A STUAB	US Navy, US Marines	ISR/RSTA, EOD, Force Protection	III	MS-B
Viking 400	Special Ops	ISR/RSTA, EW, Force Protection	III	MS-C
<b>GROUP 4 ~~~~~ &gt;1,320 LBS, &lt;18,000 MSL, ANY SPEED</b>				
MQ-1C Gray Eagle	US Army	ISR/RSTA, C3, Log, PS/TCS, FP	I D	MS-C
MQ-1B Predator	US Air Force	ISR/RSTA, PS/TCS, FP	I D	MS-C
MQ-9 Reaper (Fire Scout)	US Navy	ISR/RSTA, ASW, SUW/ASUW, MIV/OMCM	I C	MS-C
<b>GROUP 5 ~~~~~ &gt;1,320 LBS, &gt;18,000 MSL, ANY SPEED</b>				
MQ-4A/B	US Navy	ISR/RSTA, EW, PS/TCS, SUW/ASUW, FP	I D	MS-B
MQ-9A Reaper	US Air Force	ISR/RSTA, EW, PS/TCS, FP	I D	MS-C
RQ-4A Global Hawk	US Air Force	ISR/RSTA, C3, PS/TCS	I D	
RQ-4B Global Hawk	US Air Force	ISR/RSTA, C3, PS/TCS		
<b>LIGHTER THAN AIR</b>				
Blue Devil	US Air Force			
Long Endurance Multi-Intelligence Vehicle (LEMV)	US Army	ISR/RSTA, C3	Other	Pre MS-B
Persistent Threat Detection System (PTDS)	US Army	ISR/RSTA, C3, Force Protection, Inspection/Identification	Other	Other

Roadmap & Catalog: <https://extranet.acq.osd.mil/uwir/> (CAC Protected)

Roadmap: <http://www.acq.osd.mil/sts/organization/uw.shtml>





# OSD is Improving Interoperability and Affordability of UAS GCSs Through Open Business Processes



**1 Feb. 2009, OUSD (AT&L) Mandates Common GCS Architecture**



**2 Sept. 2010, OUSD (AT&L), Mandates More Competition**



**3 Mar. 2011, UCS Publishes Common GCS Architecture Vol. 1**



**4 Mar. 2011, GCS Architecture Vol. 2 Released**



**5 Jun. 2011, Open Bus Model Released**



OSD has developed a common architecture and designed an open business model to meet its objectives

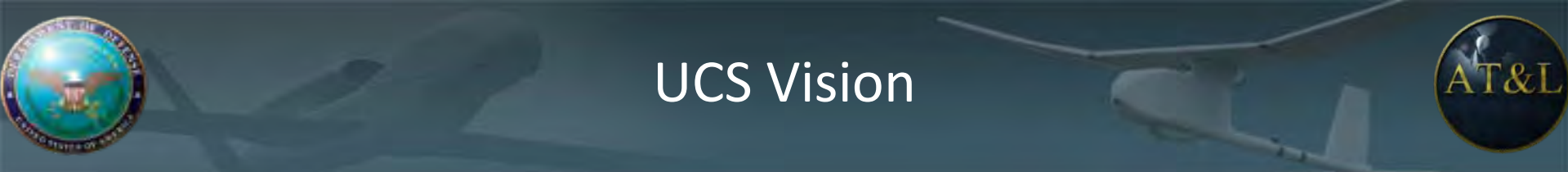


# OA Acquisition Objectives

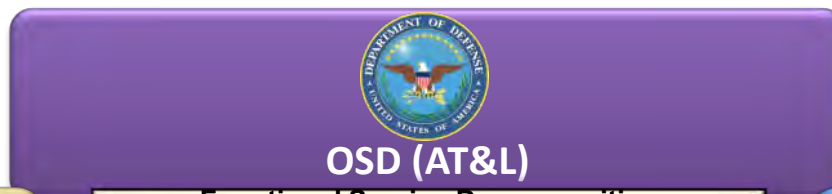


To remove the traditional barriers to Effective Competition in the UAS Control Segment and provide market access to a broad, heterogeneous industrial base of software providers in an agile acquisition and integration environment.

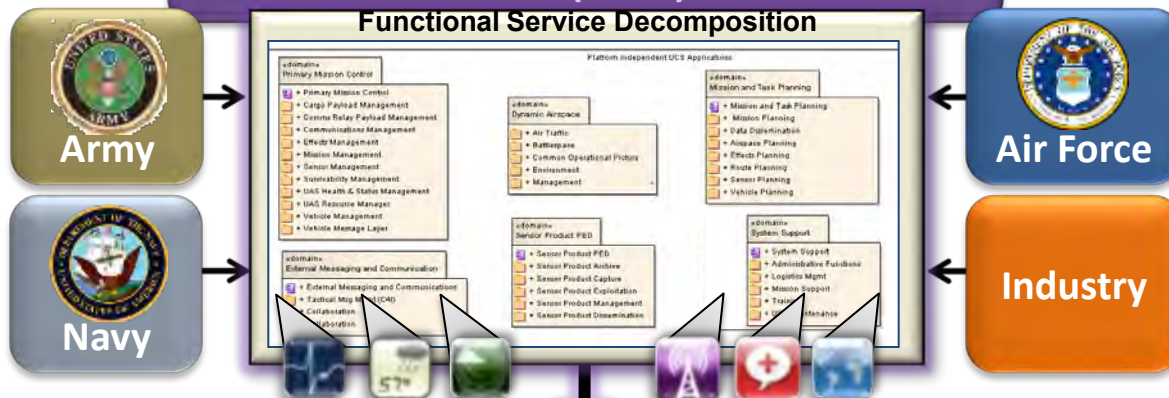




### Governance Process



### Functional Service Decomposition



### Interfaces, Data Models, and Documentation



Best-of-Breed GCS with competed services and maintainability

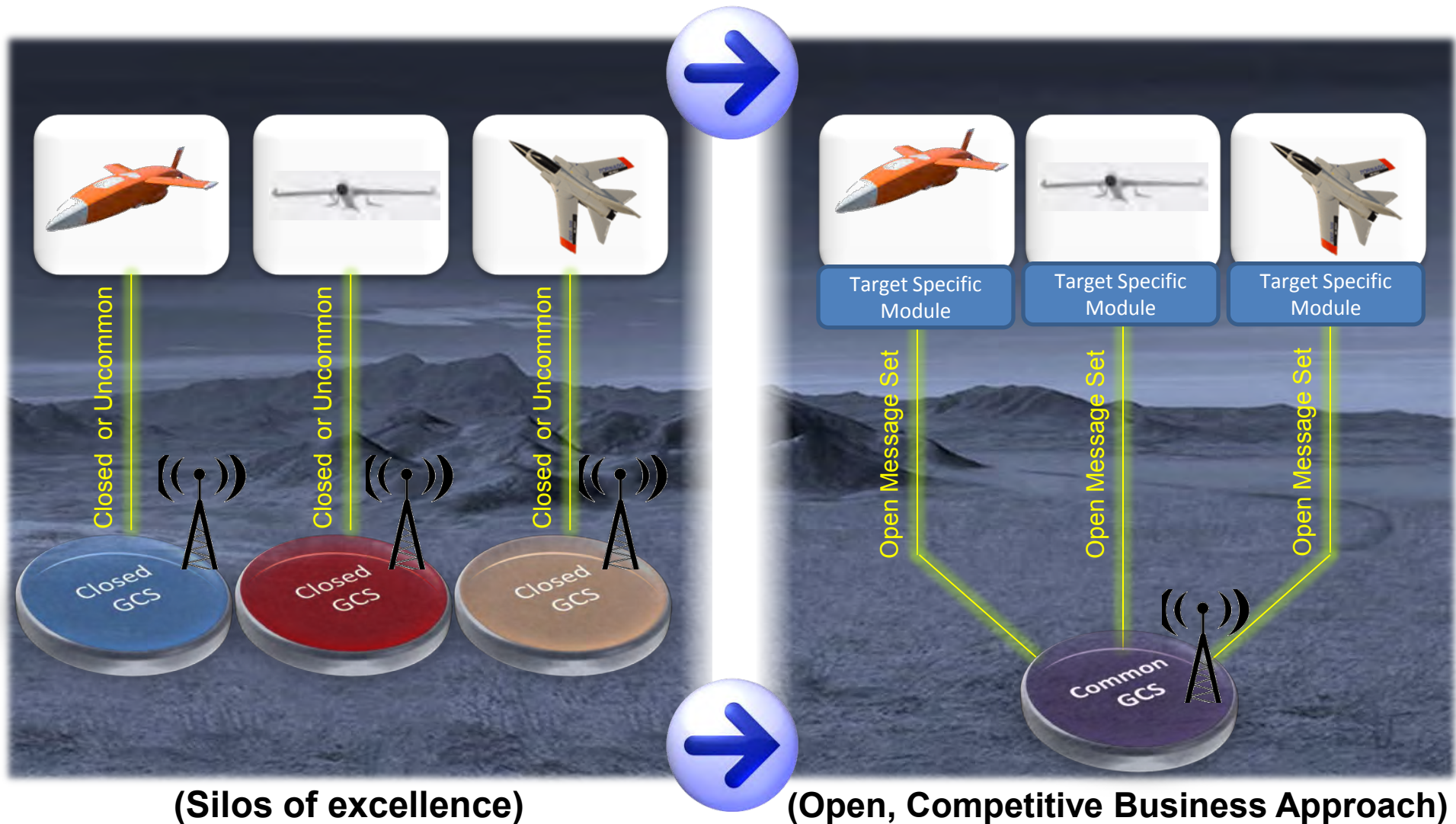
Chartered by Joint UAS Task Force Interoperability IPT Technical Society  
SAE Operating Rules per Public Law 104-113 (NTTAA) and MB Circular A-119  
Program of Work and Operating Rules in DoDAF AV-1  
UCS WG includes all PoR Use Cases for development of UAS Standard





# Acquisition Opportunities

Standards-based Interconnection..

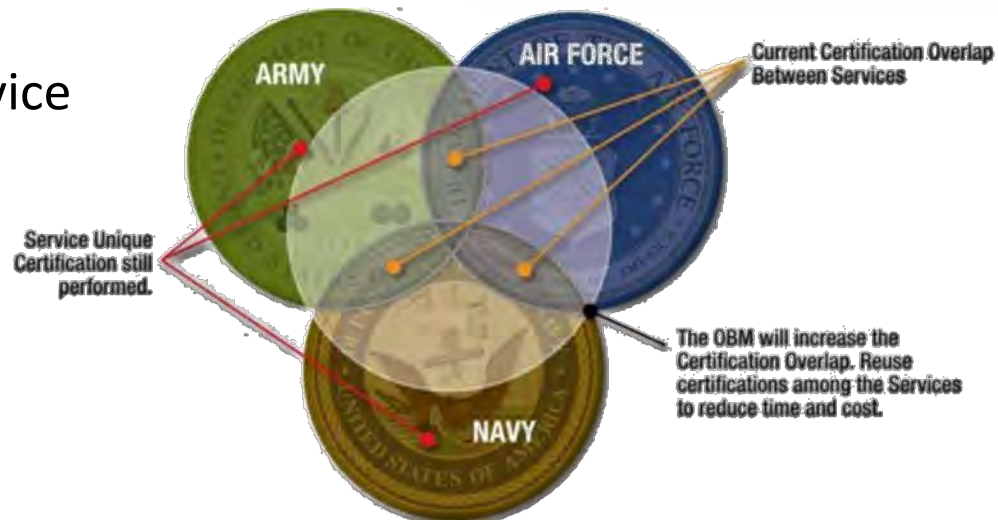




# Summary



- Unmanned Warfare has had continuous scrutiny for portfolio efficiencies
  - Congress/GAO
  - USD(AT&L)
  - UAS Task Force
- Significant efforts is underway within OSD, AT&L focusing on affordability
  - “Should Cost” “Will Cost” of UAS systems
  - Open Business Model (OBM) vision for UAS GCSs
  - Open Architecture – Reuse
  - Remove Redundancy across Service Certification
  - **Reuse verse Start New**







# Backups



# Backups



## ***Coordinated 2011-2036 Vision for Services and Industry***



**Increased Affordability**

2011-2036 Edition planned for 3<sup>rd</sup> Qtr FY11



# Airspace Integration

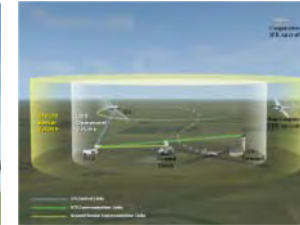


- **Methodology:** incremental approach to providing critical access to a given operations profile prior to implementing a full dynamic operations solution.
- **Immediate focus:** Near-term mission-critical access while simultaneously working toward far-term routine NAS access

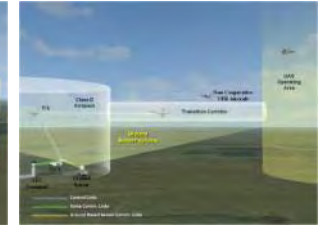
Line-of-Sight Operations



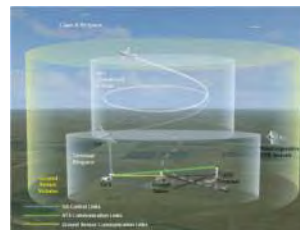
Terminal Area Operations



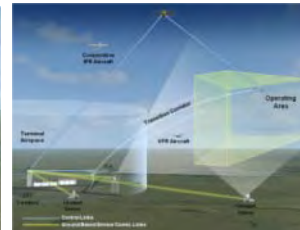
Lateral Transit Operations



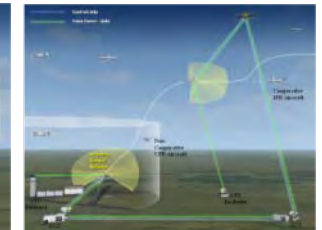
Vertical Transit Operations



Operating Areas



Dynamic Operations



## NAS Access Requirements

- Aircraft must be Airworthy
- Must be operated by a Qualified Pilot / Operator
- Compliant with Operating Rules, Standards, and Procedures

**Vision:** Ensure unmanned aircraft have routine access to the appropriate airspace necessary to meet mission requirements



# UCS Reference Architecture





## Structuring Industry

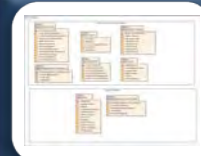


2009  
Concept  
Exploration



Dec 2009  
Version 0.5  
Incl. AV-1

## Architecture Definition & Demonstration



June 2010  
Version 1.0



Nov 2010  
IWP Demo  
Mar 2011  
JSIL Demo

## Architecture Modeling (Funded)



June 2011  
Version 2.0



Jan 2012  
Version 2.1



Enduring Organization

Feb 2009



OUSD/AT&L  
ADM Published

May 2009



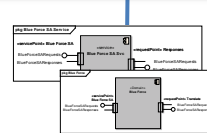
UCS  
Industry  
Days

Dec 2009



UCS Architecture  
v0.5  
Released

Jun 2010



UCS Arch  
V1.0  
Released

Aug 2010



UCS Arch  
V2.0  
Kickoff

Nov 2010



IWP  
Demo

Jan 2011

Additional  
OSD Funding

May 2011



UCS Industry  
Brief

July 2011



UCS Arch  
V2.0 to Be  
Released



HMI Study Plan  
kickoff

Sept 2011



Additional  
Experiments  
with 3rd party

Nov 2011



Implementation  
Structuring

Migration  
Plan for  
PoR

Interfaces  
& Models  
for all PoR

Jan 2012



UCS Arch  
V2.1 to Be  
Released





# **49<sup>th</sup> Annual NDIA Conference Targets, UAVs & Range Operations Symposium & Exhibition**

## **Boeing QF-16 Program – Ready for Test**



**QF-16 Full Scale Aerial Target**  
**Boeing Global Services and Support**  
**Maintenance, Modifications, & Upgrades**  
**Aircraft Sustainment & Maintenance**

**Dr. Kevin A. Wise**  
**Senior Technical Fellow**  
**QF-16 Chief Architect**  
**October 26, 2011**

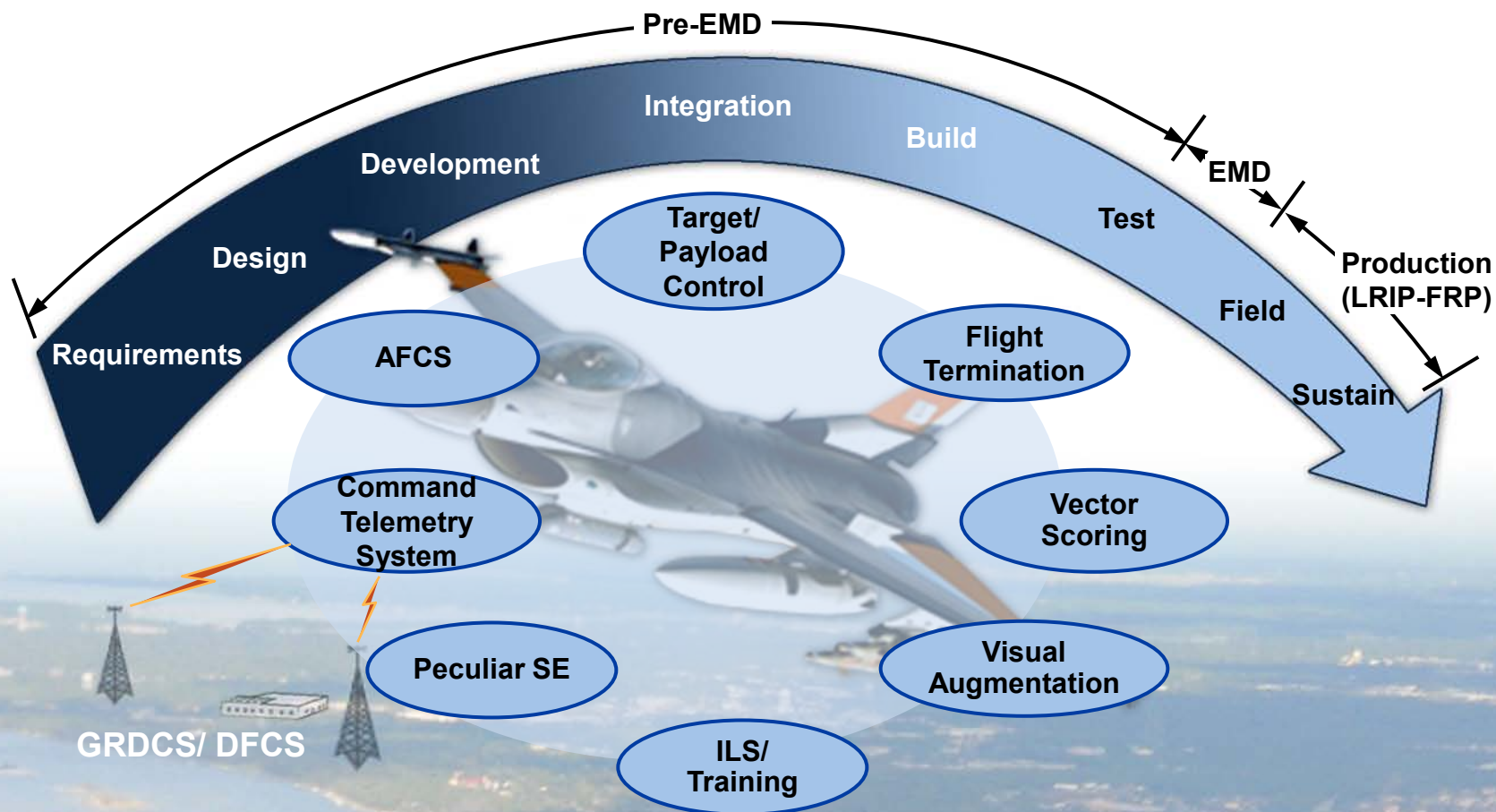
# Boeing Targets / Decoys / UAS



- Cost Effectively Converting Highly Reliable, NDI Air Vehicles
- Providing Foundation for New Development Programs
- Boeing's Systems Integration Expertise and Teaming
- Application of Boeing Critical Technologies
- Synergy Among Our Targets, Unmanned Systems, and Weapons Programs



# QF-16 Overview

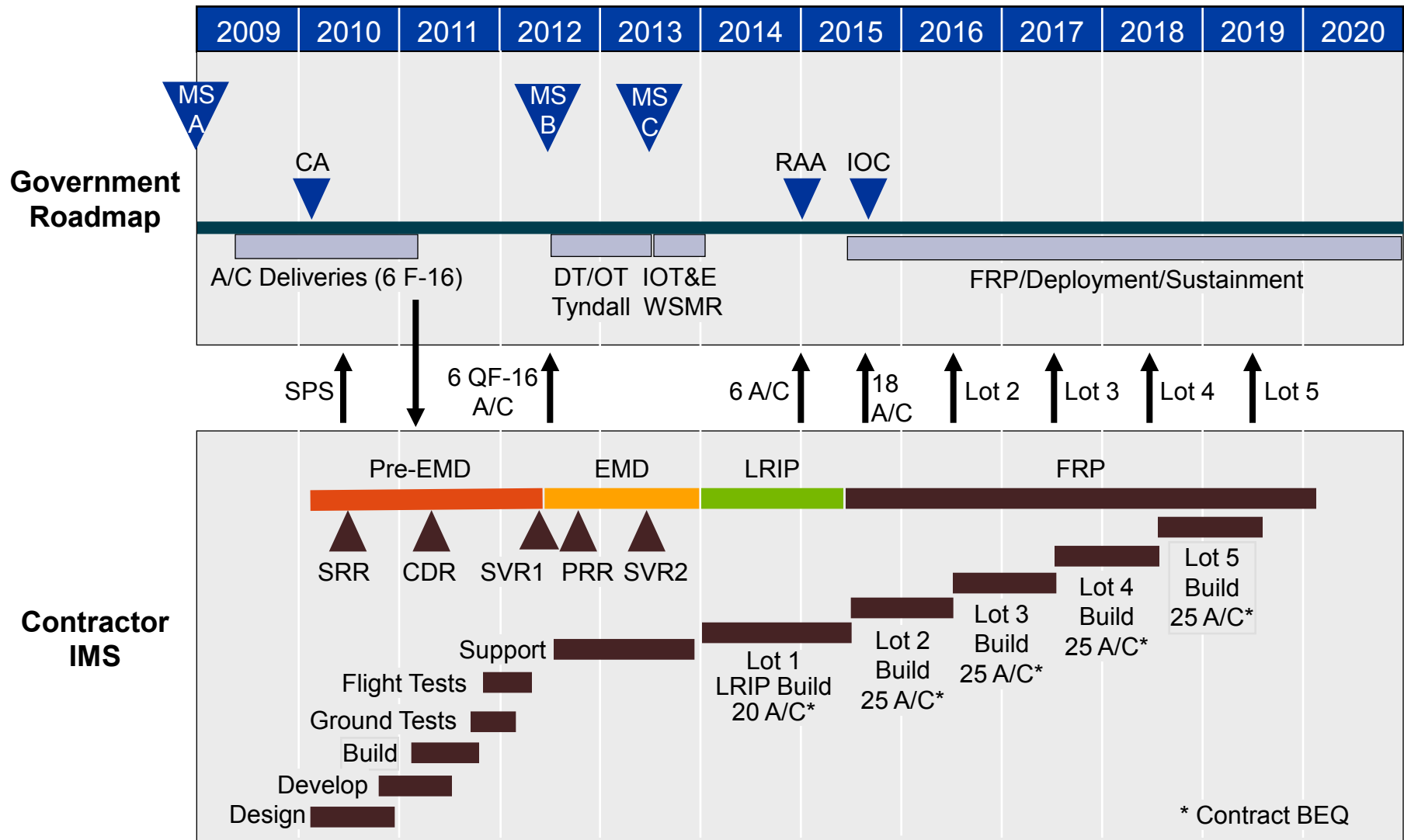


## Key Features

- Follow on for QF-4 Program: Supersonic, High-G, Heavy Payload Capability
- Satisfies Title 10 "Live Fire/Lethality"
- Provides 4th Generation Threat Representation

# QF-16 FSAT Roadmap Meets All Government Milestones

APPROVED FOR PUBLIC RELEASE



APPROVED FOR PUBLIC RELEASE

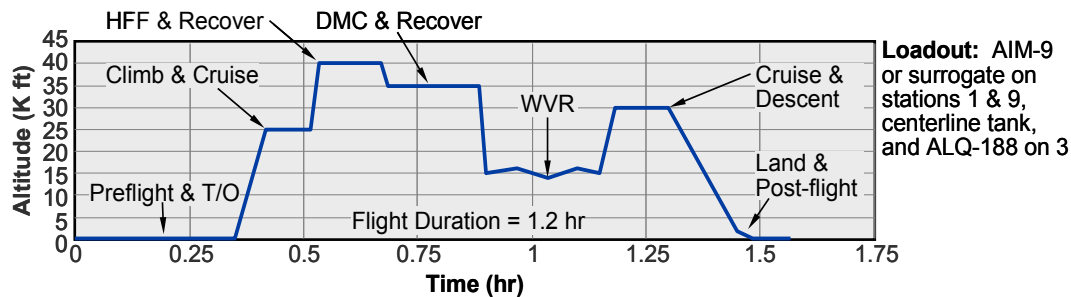


# Mission Requirements



## QF-16 Design meets Mission Requirements

- 4<sup>th</sup> Gen Threat
- F-16 Maneuverability
- Minimized impact to RCS
- Countermeasures
- 120nm GRDCS datalink
- Weapon accuracy scoring
- Range Safety – Flt Termination
- Piloted & Unmanned
- Reliable
- Supportable – Test Equipment
- Growth – Phase II Air Superiority Target (AST)



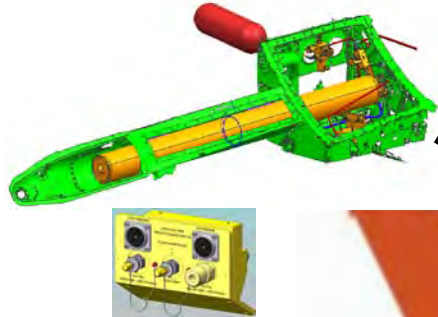
*The QF-16 is designed for Mission Success*



# Overview of DPE Installations



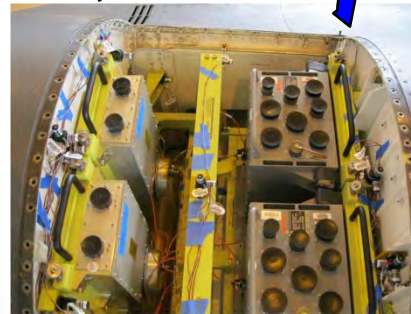
**VAS – Visual Augmentation System**



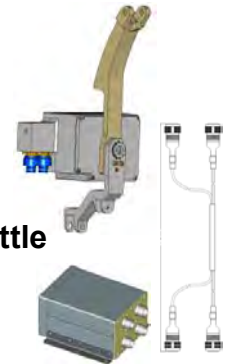
**URAP – Universal Remote Auto Pilot**



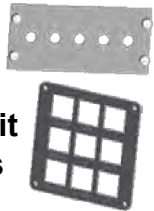
**AFCC Automatic Flight Control Computer**



**Autothrottle**



**Cockpit Panels**



**Backup Altimeter**



**CTS – Command Telemetry System**



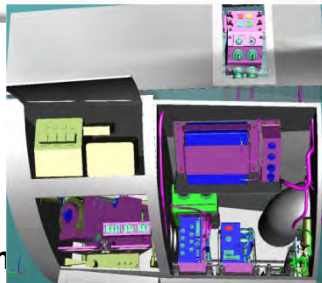
**VSS – Vector Scoring System**



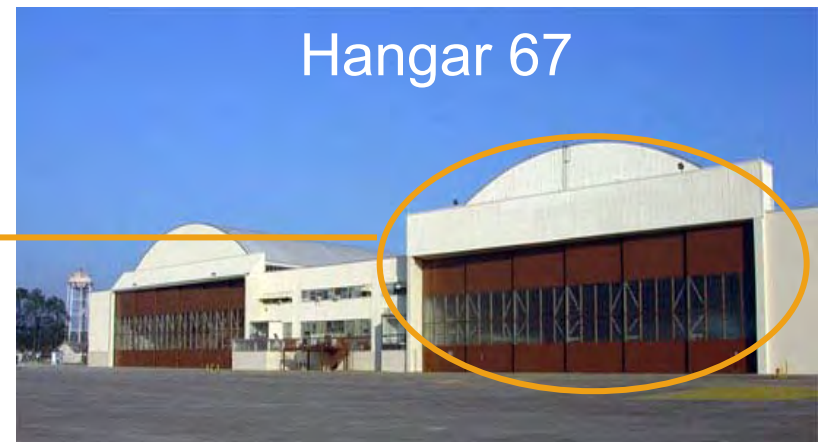
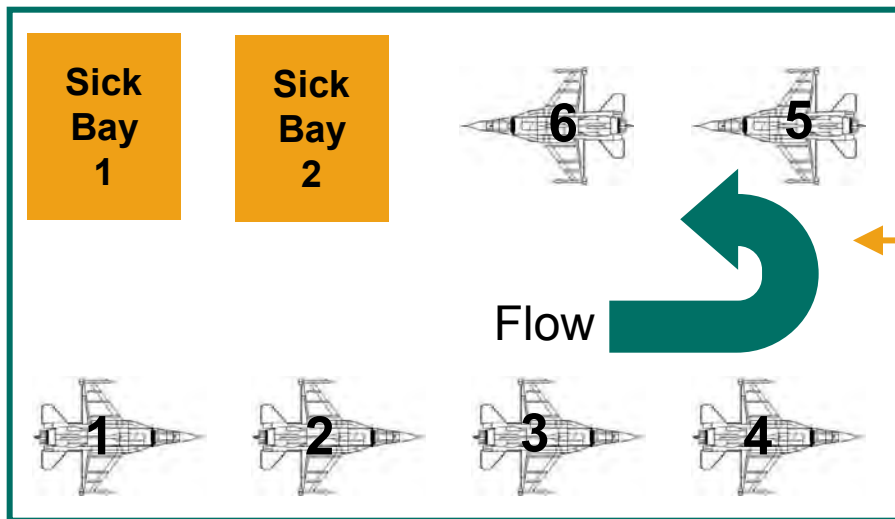
**PCS – Payload Control System**



**FTS – Flight Termination System**



# Drone Conversions Underway at Cecil



- Cecil Field Recovery of first F-16
  - On time readiness
  - Trained and experienced support personnel



*Lean cellular production supports affordable, high quality, on time performance*

# Exceeding Expectations



## Product Improvements

- CTS:
  - Improved TVI clock/position
  - Improved data latency
  - Improved frequency stability
  - Antenna switch feedback
  - Surge suppression
- Payloads:
  - Increased payloads power
  - All 8 wing stations active
  - Pre-wired spare payload discretes
  - Modular payload design for easy programmability
- Vector Scoring:
  - Improved scoring coverage
  - Shock isolated TRIM units for improved scoring accuracy
- Low profile antennas for RCS
- URAP available for improved navigation accuracy & GPS/TCS growth path
- More than double reliability
- Spare I/O available for growth
- Improved BIT and fault isolation/detection
- RCC-319 compliant Flight Termination System



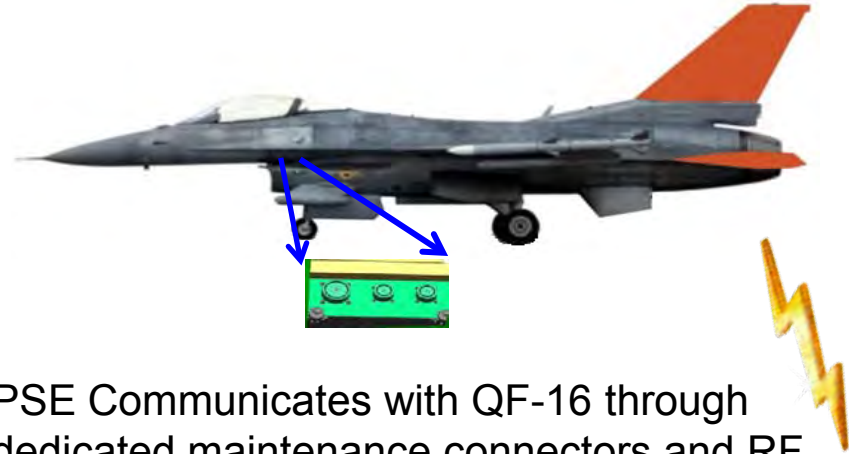
***The current QF-16 design improves on a successful QF-4 design***



# QF-16 Peculiar Support Equipment (PSE)



Ground Servicing Screen with B1 stand for safe cockpit exit after engine start



PSE Communicates with QF-16 through dedicated maintenance connectors and RF



Portable Flight Line Tester for OFP load, system initialization, and diagnostics

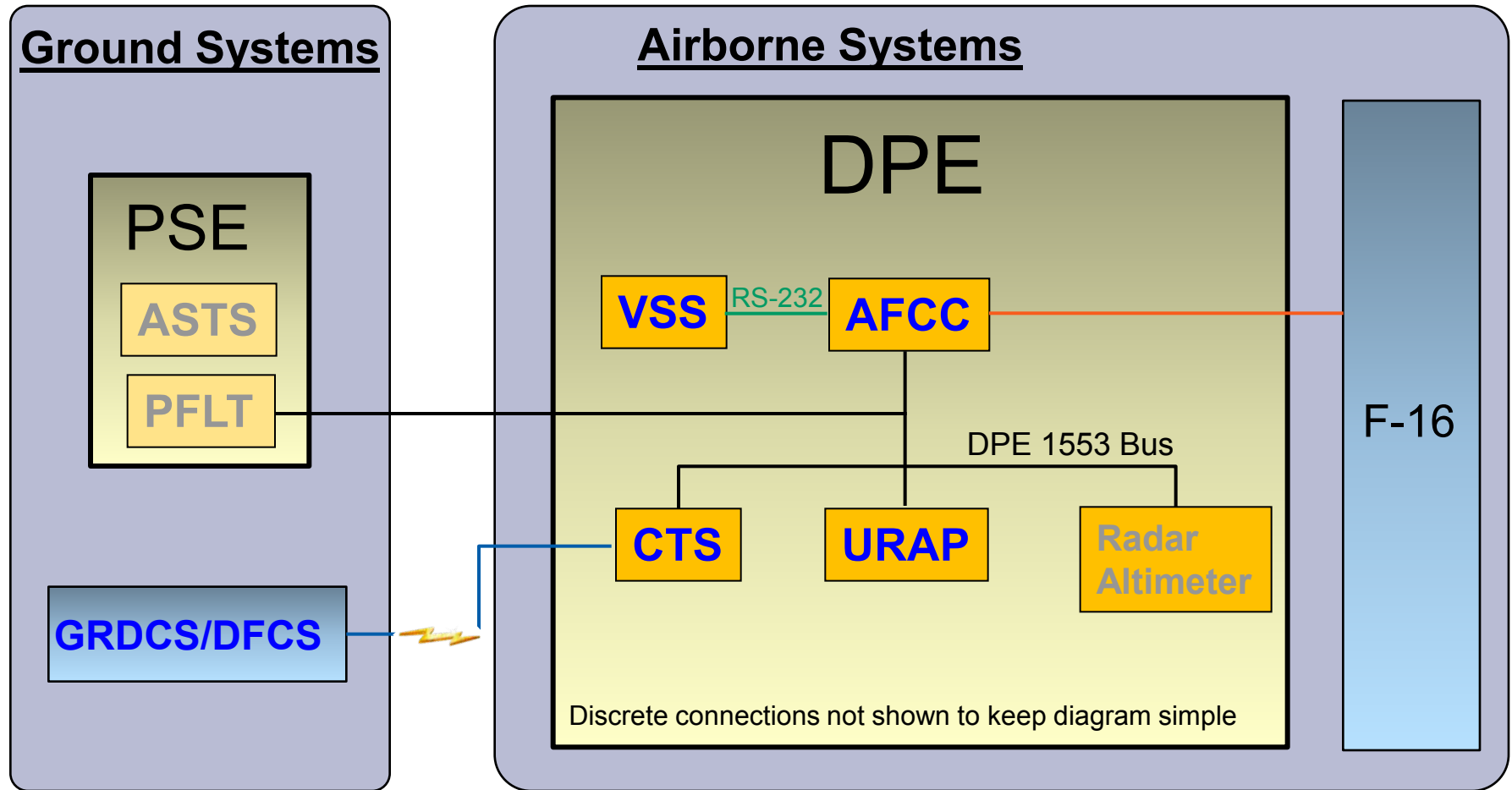


Trailer-mounted Automated System Test Set for Acceptance and Pre-Mission Testing

## Airborne System Architecture (Software View)

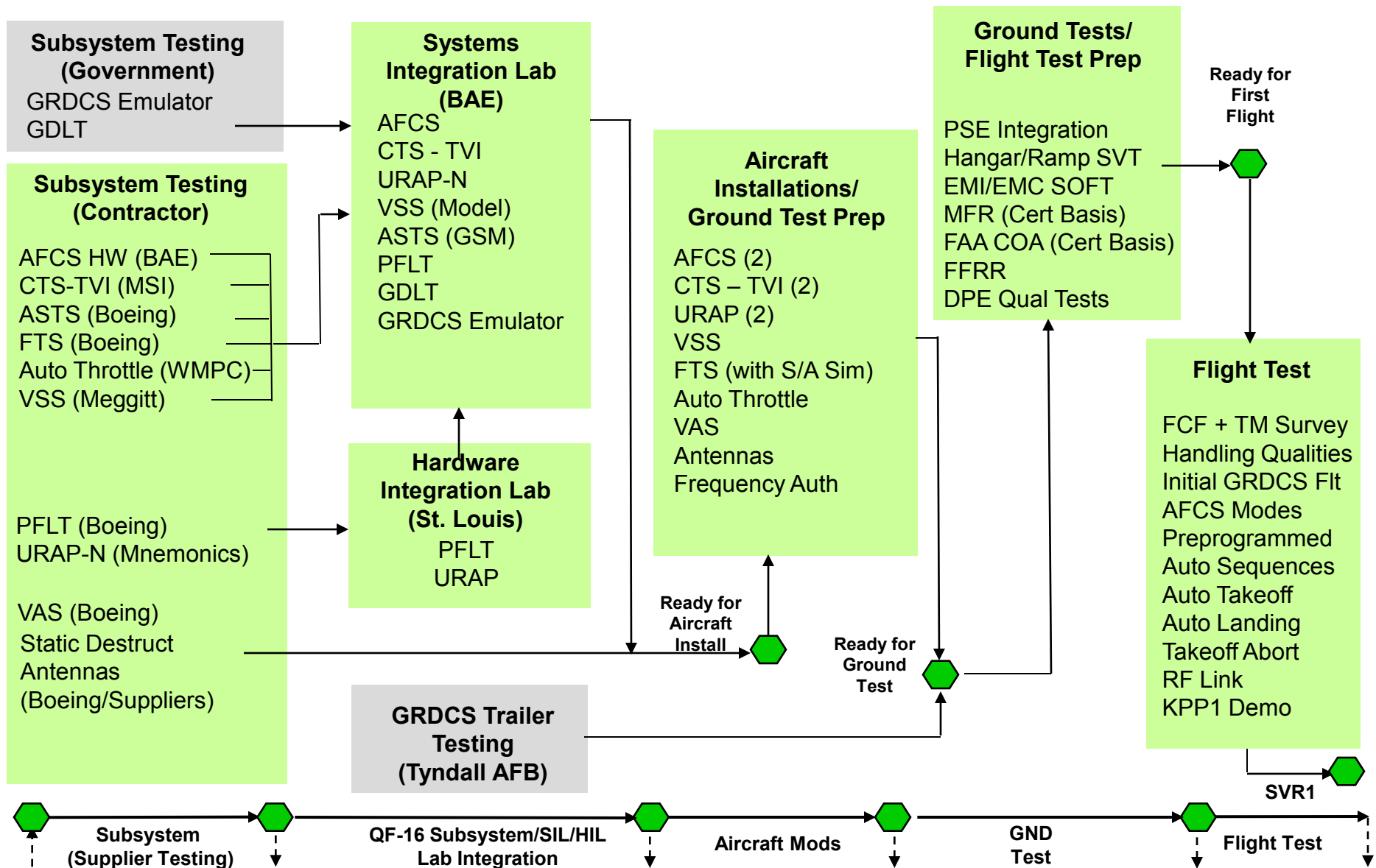


Systems With Major Airborne Software Components Highlighted in **Blue**

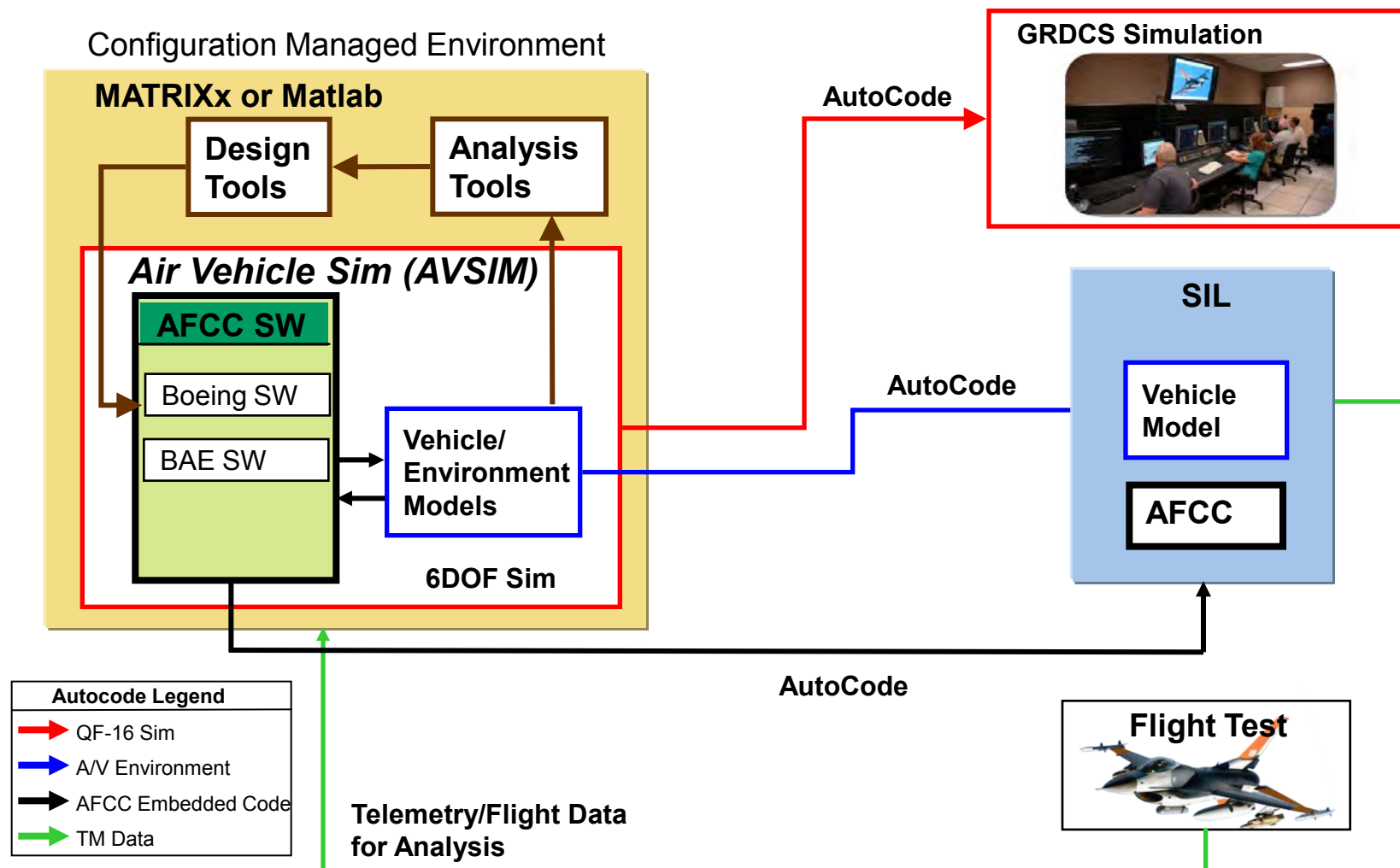




# System Verification Flow



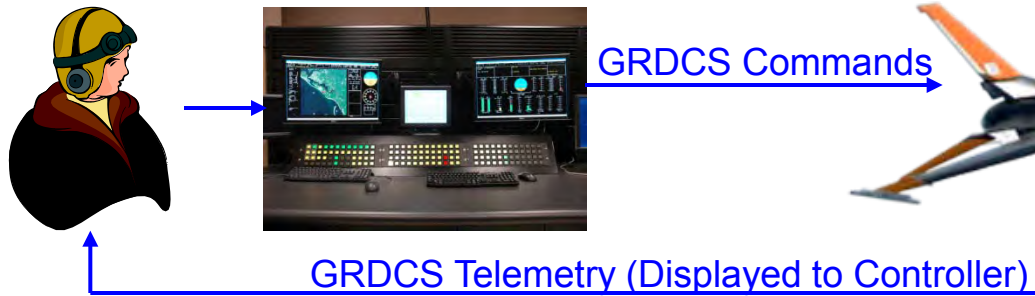
# All QF-16 Sim Models and Products Autocoded From Central Simulation



# GRDCS Operations

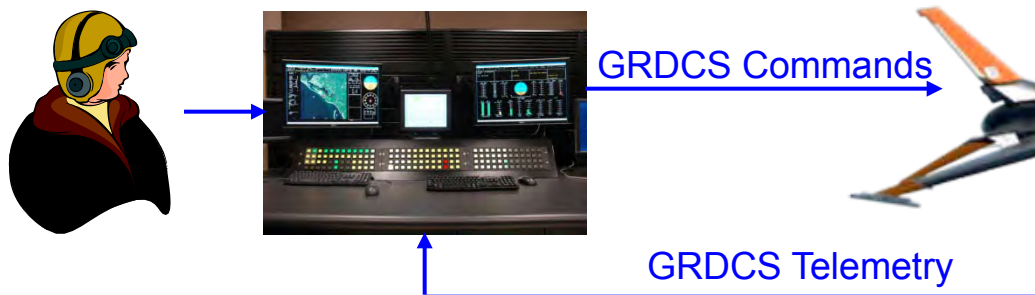


## GRDCS Manual Mode



- **Controller** inputs manual command (e.g. stick, throttle)
- **Controller** flies autopilot modes (e.g. altitude hold, speed hold)
- Controller initiates maneuvering

## GRDCS Auto Mode



- **GRDCS** computes required commands (e.g. stick, throttle)
- **GRDCS** is controlling aircraft flight path
- Controller still initiates maneuvering (breaks Auto mode)
- Onboard software behaves the same whether in auto or manual mode

## Onboard Auto Sequences

- All Attitude Recovery (AAR)
- Automatic Takeoff (ATO)
- Takeoff Abort (TOA)
- Escapes
- Autonomous (e.g. Loss of Comm)

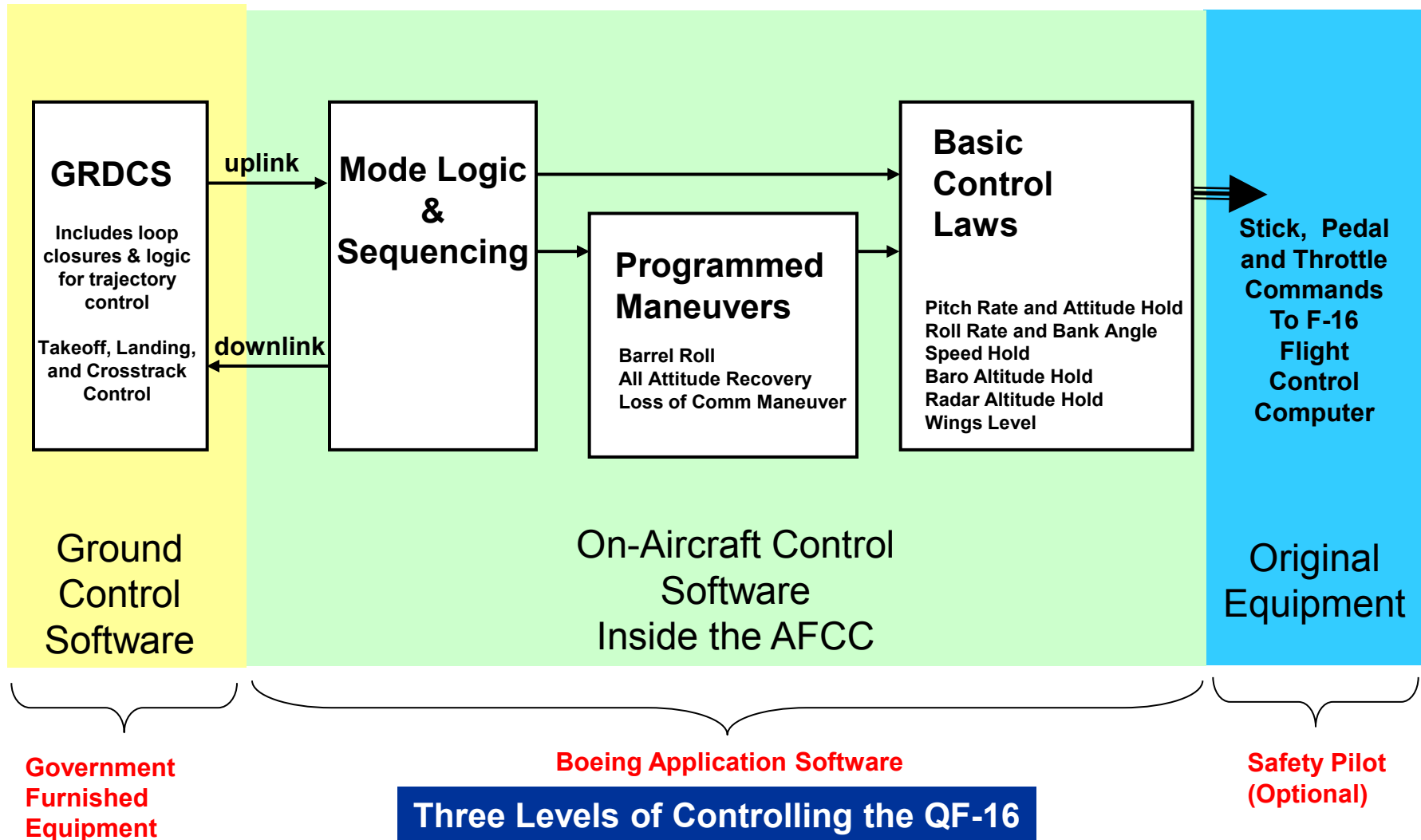
**Verifying Integration of GRDCS and DPE Software is an Important Development & Risk Reduction Activity**

# SIL Lab Layout Diagram – Pilot Station



- Cockpit View
- Observer View
- CsGTI PC
- COTS Stick
- COTS Throttle
- COTS Pedals

# QF-16 Levels of Vehicle Control and General Control Law (CLAW) Architecture





# FQT Test Definition Process

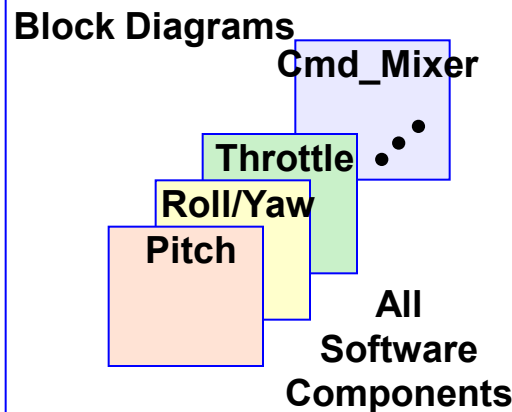
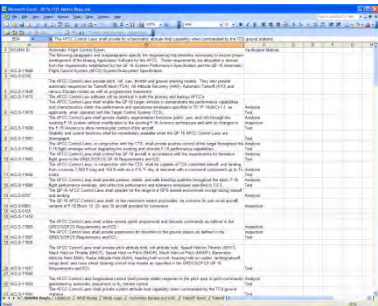


**Requirements**

**Traceability**

**Test**

**DOORS QF-16  
Software  
Requirements**



**Test  
Matrix  
DB**

**FQT  
Test  
Definitions**

**Verification Testing**

**Requirements Verified In:**

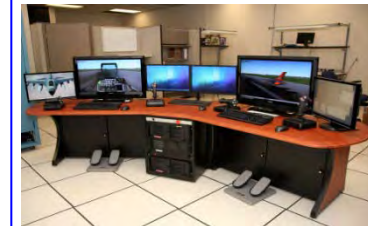
- **Verification Tests**
- **System Level Tests**

**Test Allocation To Test Environment**

**AVSIM &  
BAE Desktop**



**SIL**



**Flt  
Test**



**Component and  
System Level Tests**

*All Aspects Are Under  
Configuration Controlled*

# Growth Potential



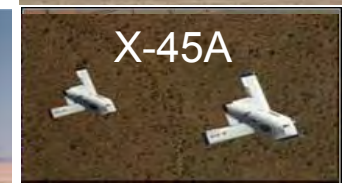
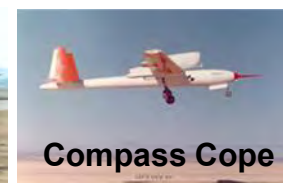
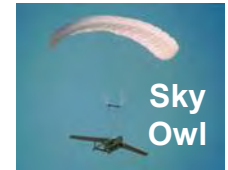
## ■ GPS Navigation -

- Accurate aircraft state estimation during all flight phases
- Accurate heading and gyro bias estimation reduces risk
- Mature navigator used on X-45, Phantom Eye, JDAM, SDB, others

## ■ Leverages Boeing's experience and proven autonomous system software

- Guidance, Navigation, and Control Software
  - Autocode development process improves quality, reduces costs and schedule
- Autonomous System Operation
  - Reduced manpower costs in support of QF-16 FSAT CONOPS
  - Improved mission assurance and first time quality
  - Improved safety, accuracy, and repeatability
  - GRDCS controlled autonomous system operation

## ■ QF-16 Operation at Alternate Test Ranges



# Program Summary



- **The Boeing QF-16 Program leverages QF-4 supply base and maximizes the use of existing hardware and software capabilities to provide a low risk drone peculiar equipment solution.**
- **QF-16 Equipment in qualification testing. Software progressing towards Formal Qualification Testing. Aircraft Integration and Checkout beginning at Cecil Field. First Flight planned for Feb 2012**

**Non-OEM Experience**



**System Integration Experience**



**Unmanned Experience**







# Electronic Combat Range

10/26/2011

*Presented to:*

**NDIA**

Targets, UAVs & Range Operations Symposium

*Presented by:*

**Joseph R. Albert**

Test Management Branch, Section Head





# Electronic Combat Range



Robert Jensen

Test Management Branch Head

[robert.b.jensen@navy.mil](mailto:robert.b.jensen@navy.mil)

760.939.6807

Joseph R. Albert

Test Management Section Head ECR

[joseph.r.albert@navy.mil](mailto:joseph.r.albert@navy.mil)

760 939-9125

# History



The Electronic Combat Range (ECR) was established in 1967 and originally known as the Electronic Warfare Threat Environment Simulation (EWTES). It was established in a response to an urgent Vietnam wartime need for realistic pilot training.



# Electronic Combat Range



ECR is the Navy's principle open-air range for the test and evaluation of airborne electronic combat systems. ECR supports a combination of land and naval systems (littoral threat). The ECR provides engineering support, developmental and operational testing, analysis and training resources for users of systems that counter or penetrate air defenses.

ECR has the capability to support Top secret and special-access level security missions with minimum electromagnetic interference.



# Location

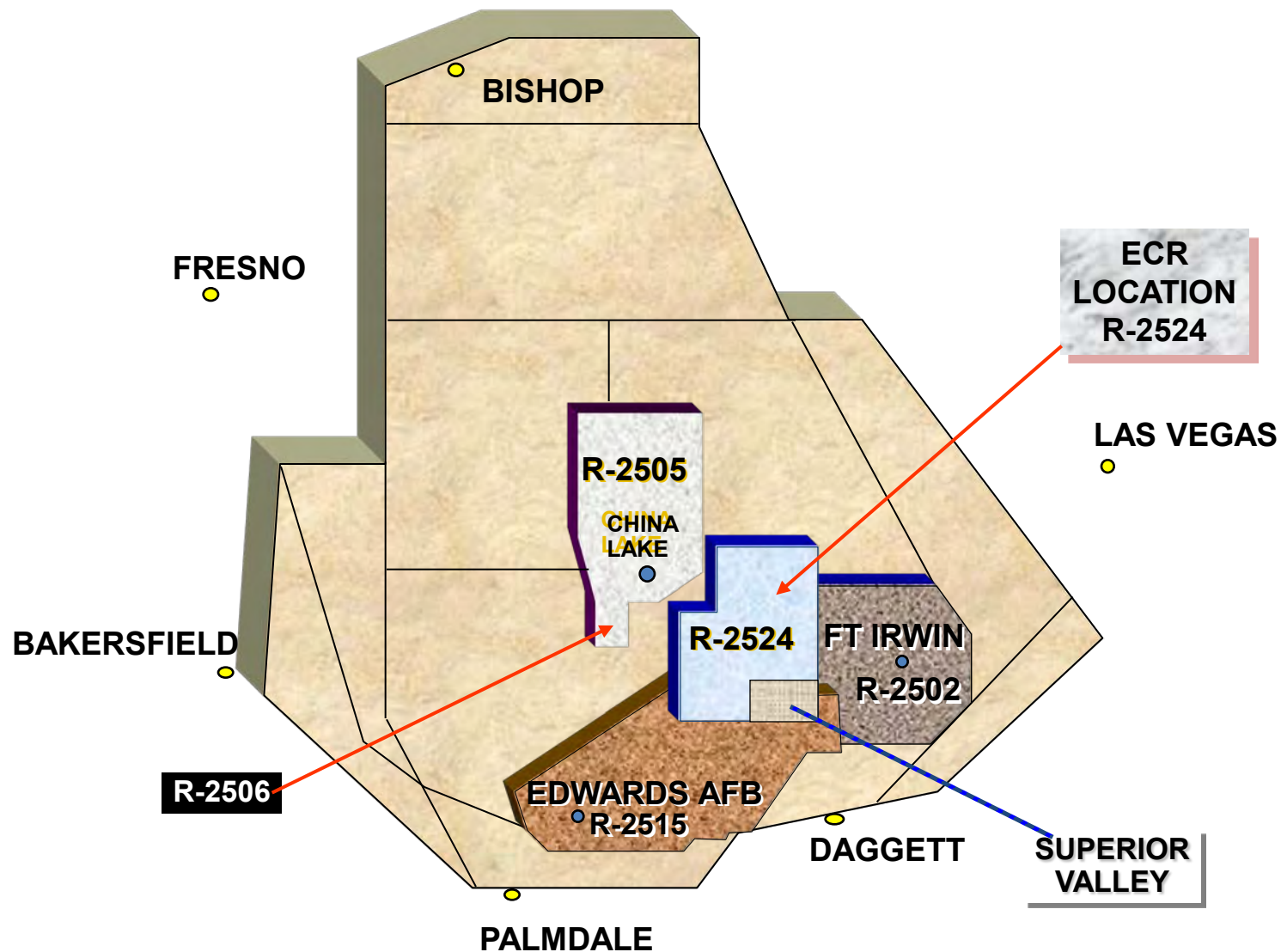


ECR is part of the NAVAIR Land Ranges and is physically located in California at China Lake's South Range.

It is comprised of 1,200 square miles of restricted airspace overlying 900 square miles of Navy land which offers ample room for either single or multiplatform events.



# R-2508 Airspace





# Mission



Provide a realistic electronic combat environment including threat systems; operations and range control; instrumentation; Time, Space, Position Information (TSPI), telemetry, optical and communications; data processing and display systems; signal monitoring, calibration of systems and threat assessment.



# Developmental Test & Evaluation



ECR offers a wide variety of threats, to include simulators, surrogates and actual systems all providing a threat-rich environment. Open-air hardware-in-the-loop testing at the ECR helps bridge the gap between laboratory and open-air testing.

A broad range of EW technologies are offered: pulse, continuous wave, Doppler and multispectral. Test emitter spectrums include infrared, radio frequency, electro-optical, and millimeter wave.



# Types Of Testing



Electronic countermeasures (ECM) effectiveness, Radar Warning Receiver (RWR), Unmanned Aerial Systems (UAS), expendables – chaff and flare effectiveness, towed and air launch decoy testing, Anti-radiation missile (ARM) flight testing to evaluate seekers and avionics, tactics development, training.



# Equipment / Instrumentation / Data



Scope video, boresight video, display video, radio recordings, crew hot mike recordings, digital data, raw unprocessed data, sorted corrected data (wild point flags and sorted by time).



# Slate Range Facility (SRF)



Located on the Slate mountain range overlooking most ECR sites at 4,700 feet. The site aligns threat radars to a single point, and is an important element in the certification of ECR systems. SRF includes a static target performance exerciser (STARPEX), which provides beacon and radar calibration support for daily operational readiness exercises in test preparation. SRF also provides moving targets that simulates aircraft motion for electronic countermeasure devices.





# UAS Facility



Working towards bringing more UAS work to ECR with a new facility and adding the capability of launch and recovery. Concurrent operations are possible with other Electronic Warfare (EW) missions via altitude separation.



# Test Management Function



- Initial contact with the range
- Help design Test Plan if unknown
- Set up test and introduce you to the range and how it works to include data products
- Help put together runsheets
- With you until completion of your program



# Planning Time Line



- -6-12 Months
  - Customer/ECR Planning
    - Radar/System Requirements, SRF (Slate Range Facility) Requirements, Data Requirements, Number of Flights and Flight hours
    - Network Connectivity Issues, IT Assets require planning
    - Ordnance: Chaff, Flares, Weapons, etc.
  - Long Range Schedule Input
- -3 Months
  - Formal Estimate
    - Current Year \$\$\$
  - Frequency Authorization Submittal (if required)
    - New emitters
    - Telemetry Frequencies
    - Change in the EA Approval
- -3 Weeks
  - Funding on Station
  - Test Plan on Station
    - 3960.4B if Developmental Testing
    - Operational Testing does not require test plan
    - ROEs (Rules of Engagement) established for radars

# Time Line (continued)



- -2 Weeks or more
  - Test Plan Approval
- -1 Week
  - Firm Schedule
- -2 Days
  - Run Sheets / Scripts
- 0 Day
  - Test Conduct
  - DVD Videos available 15 minutes after completion of test
- +1 Working Days (Dependent on Amount of Data)
  - Quick Look Data (Non QA'd) may help make decisions for customers flying more than once a week
- +5 Working Days (As Negotiated)
  - QA'd Data Products Delivery

# Questions?





# INTRODUCING OUTLAW ER

# OUTLAW

- Affordable
- Easily Deployable
- Manual Or Auto Piloted
- Numerous Payload Options
- Expandable Capabilities



**49<sup>th</sup> TARGETS, UAVS & RANGE OPS**  
**Fort Walton Beach, FL, February 2011**

*Presented By:* Greg Chando  
Systems Engineer

# Outlaw ER First Flight

September 27, 2011

# OUTLAW



Outlaw ER  
Test Flights



# Why Outlaw ER?

# OUTLAW

- ✓ Griffon's customers need:
  - Much longer endurance.....  
(Extended Range – “ER”)
  - More payload weight/volume
  - Easier payload access/integration
  - Power generation
  - Expand the proven and qualified MQM-170A Outlaw systems and certifications
- ✓ Offer range and endurance to fully utilize the Outlaw's satellite Command and Control (C2) link
- ✓ Offer more capability without disrupting Environmental, Safety, Frequency, and Reliability documentation in place at test and training ranges.
- ✓ Continue to offer the industry's most cost effective unmanned aircraft systems and Flight Services.



Boomer...  
Step to ER

# OUTLAW

Outlaw Boomer



Outlaw ER





# What is Outlaw ER?

# OUTLAW

- ✓ A flight-proven unmanned aircraft / surrogate UAV target based on proven systems that have flown thousands of air defense training and payload test missions.
- ✓ Low-cost, tactical size, payload flexibility, 6-9 hour endurance, and multi-mission flexibility make it an extremely versatile tool for Test and Evaluation.
- ✓ Multi-mission solution for gun/missile tracking and live fire, payload test /development, ISR training, sensor and weapon development, and UAV system research and development.
- ✓ Griffon Aerospace is the U.S. Army's Target Management Office and the U.S. Navy's Prime Contractor for Outlaw design, production, and flight operations.





# Missions Commonly Supported

# OUTLAW

- ✓ Systems/Subsystem Research and Development
- ✓ Systems Test and Evaluation
- ✓ Surrogate UAS Training
- ✓ Tracking and Engagement
- ✓ Range Surveillance / Debris Observation
- ✓ UAV Payload Development Flight Ops
- ✓ Long Endurance Shipboard Defense Engagements



# Design

# OUTLAW

**AIRCRAFT CONFIGURATION:** High wing, boomed V-tail monoplane, pusher engine configuration

**FUSELAGE LENGTH:** 9.18 ft / 2.8 m

**WING SPAN:** 15.1 ft / 4.84 m

**PAYLOAD BAY VOLUME:** 1.9 ft<sup>3</sup> / .054 m<sup>3</sup>

**MAX HEIGHT IN PAYLOAD BAY:** 1 ft / .3 m

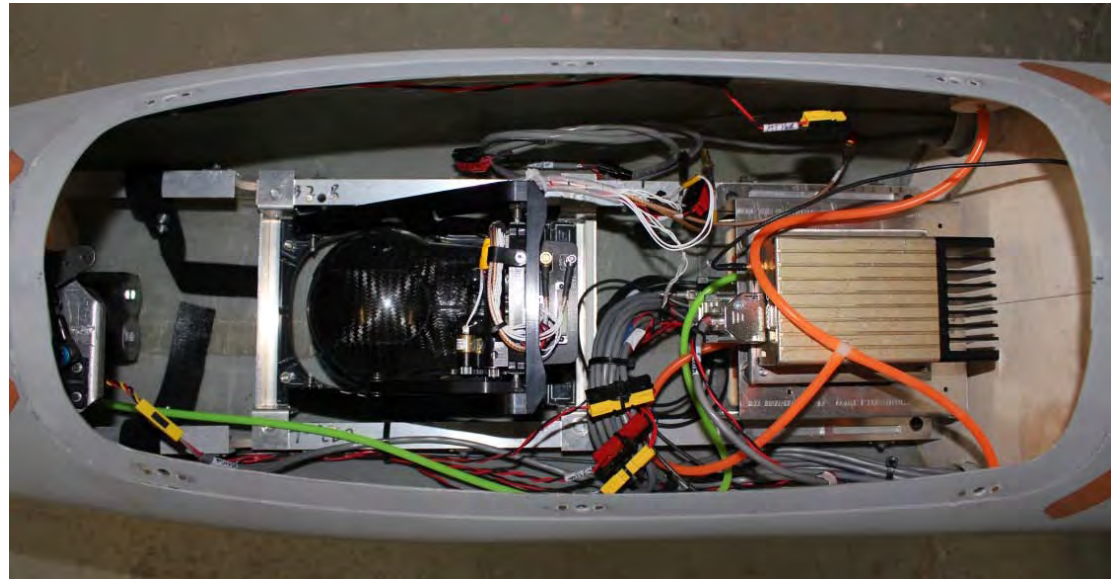
**GROSS WEIGHT:** 175 lbs / 79 kg

**EMPTY WEIGHT:** 98 lbs / 34.5 kg

**STRUCTURAL LIMIT LOADS:** +/- 8 g's

**STRUCTURAL LIMIT VELOCITY:** 150 mph

**POWERPLANT:** 16 HP, 2 cylinder 2-stroke, air-cooled engine





# Performance

# OUTLAW

Parameter	Standard Outlaw	ER
Gross T.O. Weight (lb/kg).....	120/54.4	175/79
Empty Weight (lb/kg).....	76/34.5	98/34.5
Max Fuel Weight (lb/kg).....	19/8.6 (3 gal)	56/25.4 (9 gal)
Payload at Max Fuel (lb/kg).....	25/11.3	21/9.5
Cruise Speed 75% power (knts).....	80	75
Max Speed 100% power (knts).....	108	98
Controllable Slow Flight (1.15 Stall) (knts).....	52	60
Stall Speed (knts).....	45	48
Speed for Max Endurance (knts).....	64	68
Maximum Endurance (hrs).....	2.5	6-9
Maximum Range (nautical miles).....	160	594



## BEYOND VISUAL RANGE (BVR) AUTOPILOT SYSTEM

- Autonomous execution of pre-planned missions through waypoints and altitudes.
- State-of-the-art solid state acceleration and GPS position sensors and works with a laptop based ground station to provide mission execution and aircraft health and status data.
- Real-time waypoint and mission redirects are performed via the RF data link
- A 225 to 400 Mhz UHF transceiver C2 link with a transmit power adequate for 25-30 kilometer missions.
- Low cost satellite C2 link for very long range missions.



### **Mechanical Data**

Dimensions: 4.8 inches (") x 2.4" x 1.5"

Weight: 7.5 ounces

Power: 8 to 20 VDC; 3.6 watts at 12 VDC nominal

### **Capabilities**

- Multiple Waypoints (100) Capable
- Integrated 6-axis IMU
- 6DOF Simulation Support
- Integrated GPS Receiver
- PWM-Based Servo Command Outputs
- Real-Time Waypoint Route Editing

# BVR Ground Station

# OUTLAW

## BVR GCS

- BVR ground control station consists of a laptop, a communications control module, and a UHF transceiver.
- Provides pre-mission planning, mission monitoring, and real-time mission redirects.
- Mission waypoints are displayed and edited. The real-time mission data is stored and available for post-mission display and processing.
- BVR flights out to a range of 25 KM assuming minimal ground obstructions.
- Outlaw ground station is easy to use, compact, and extensively used by other UAVs.





# Standard ISR Payloads

# OUTLAW

## EO/IR GIMBALED SENSORS

- Piccolo autopilots offer standard interfaces to a variety of gimbaled camera systems.
- Griffon owns and operates TASE retract gimbals.
- Outlaw supported Marine VideoScout training by serving as a surrogate Shadow UAV.
- Stabilized and target tracking.
- JF-12 video downlinks available.



# Standard ISR Payloads

# OUTLAW

## Onboard Video Processing

- Provides onboard gimbal processing and pointing.
- Superimposes metadata on video feed.
- Image stabilization.
- Provides feed to video downlink transmitter.



## Video Downlink

- Analog video transmitters (L, S, and C).
- Different transmit power levels.
- Digital video downlinks available.

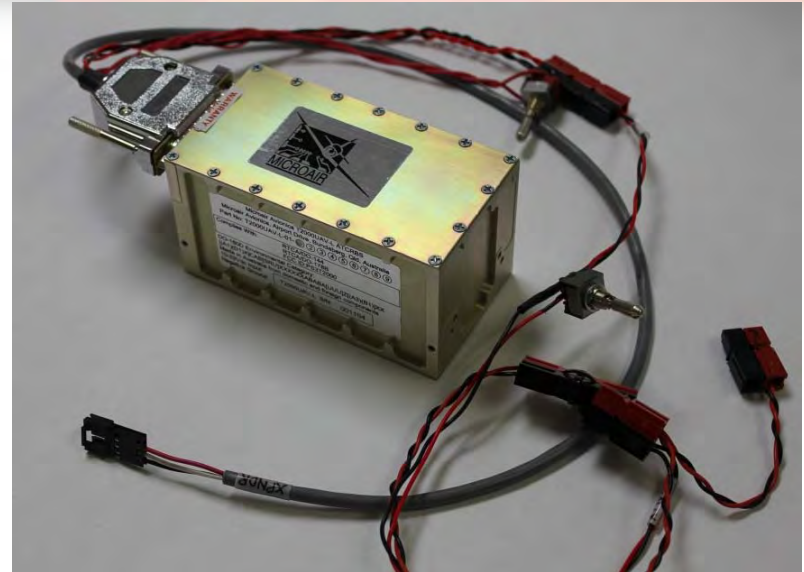


# Standard Payloads

# OUTLAW

## Transponders

- Standard Mode C IFF.
- 150 Watt pulse.
- Squawk code changeable in flight.



## Satellite C2 Datalink Modem

- Offers unlimited range for control link.
- Low speed command link.





# Standard RPVT Payloads

# OUTLAW

## INFRARED (IR) ENHANCER

- Generates IR signature per STINGER/U.S. Army requirements.
- Engagements from directly aft to nearly nose on (~300 degree).

## RADAR AND ACCOUSTIC SCORING

- Realtime round or missile scoring. Radar Scalar or Acoustic Vector

## MULTIPLE INTEGRATED LASER ENGAGEMENT SYSTEM (MILES)

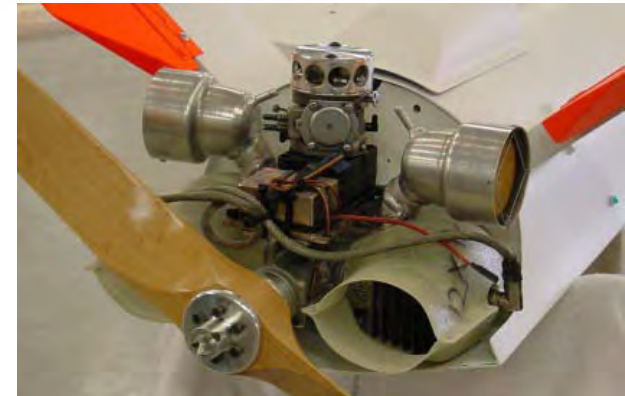
- Eight (8) state of the art laser sensors
- Optimally located for reliable detection from laser training weapons.
- Functions with on-board smoke system to provide visual hit or miss.

## SMOKE GENERATOR

- Interfaces with the transmitter to provide smoke when commanded.
- Interfaces with the MILES laser training system.
- Provides a minimum of 10 minutes of smoke visible to 3000 meters.

## RADAR REFLECTOR CORNER CUBES

- Metal corner cubes added to enhance RF signature.
- Cubes of different sizes to provide desired radar signature.



# Ground Support Equipment

# OUTLAW

## PNEUMATIC LAUNCHER

- Zero Length Pneumatic Launcher
- High pressure air storage bottles provide launch energy
- Reliably supports high density altitude operations
- Can be towed behind commercial or military vehicles
- Designed to provide easy access to the engine and vital aircraft system
- Designed to accommodate optional landing gear equipped RPVTs

## SHIPBOARD LAUNCH AND RECOVERY IN DEVELOPMENT





# Flight Operations

# OUTLAW

## MISSION OPS TEAMS

- Mission Lead works directly with the field commander to achieve training objectives.
- Pilots present the aircraft to assure maximum probability of engagement success.
- 3 people – for 1 target in the air at a time.
- 4 people – for 2 targets flying simultaneously.
- 5-6 people – for 24 hour operations.
- All pilots experienced flying RPVTs, UAVs, and RC aircraft with a minimum of 2-5 years experience.



# Ready to Serve

# OUTLAW

## Serving You... Anywhere, Anytime

- The equipment and pilots are prepared for the conditions.
- Outlaw pilots are certified in night flight and high altitude operations to offer realistic threat engagements - anywhere, anytime.





# Surrogate UAV Services Now....

# OUTLAW

- UAV Threat Simulation
- Low Cost Sensor Development
- ISR Training Surrogate
- Range Debris Inspection
- UAV Fire Support Training
- What's your problem?



# OUTLAW



# GRIFFON

## AEROSPACE

106 Commerce Circle  
Madison, AL 35758  
Telephone: (256) 258-0035  
Fax: (256) 258-0039  
Website: [www.griffon-aerospace.com](http://www.griffon-aerospace.com)



# AFOTEC

AIR FORCE OPERATIONAL TEST AND EVALUATION CENTER







# **Budget cuts: Cutting test increases bleeding -- Exponentially!**

**Major General David J. Eichhorn  
Commander, AFOTEC**



**49<sup>th</sup> Annual Targets,  
UAVs, & Range  
Operations Symposium  
Fort Walton Beach, FL**

**26 October 2011**



Distribution A: Approved for public release; distribution unlimited.  
(Approval given by AFOTEC Public Affairs Office)



# Timeless Message



- “With regard to the cost, difficulty, and time required for tests, there is mounting evidence. . .that agencies can no longer afford not to spend the money, take the time, and go to the trouble of performing sufficient tests. Such an investment may be the only way that total cost can be kept within limits of a system’s operational worth to an agency.”
  - Report of the Commission on Government Procurement, *Acquisition of Major Systems*, December 1972, p. 157



# **Adm. Mike Mullen, Chairman of the Joint Chiefs of Staff**



**"The budget has basically doubled in the last decade. And my own experience here is that in doubling, we've lost our ability to prioritize, to make hard decisions, to do tough analysis, to make trades."**

**Our culture needs to change back**



# Healthy Tension



**“Testing is the conscience of acquisition”**

**William Perry**

*If two people agree on everything,  
then only one of them is doing the thinking.*





# Phases of a Program



- 1. Enthusiasm**
- 2. Panic**
- 3. Search for the Guilty**
- 4. Punishment of the Innocent**
- 5. Rewards for Non-Participants**



# Best Practice: A More Constructive Test Approach is Key to Better Weapon Systems

(GAO Report - July 2000)



- “The [program] also constructed its test plan using optimistic assumptions. For example, program officials assumed that no hardware or software problems would be encountered during ground or taxi tests. They also assumed that one aircraft would be available for flight testing at all times and that all flights would be productive.”
  - **Assumed software error rate of 15% despite 100% on B-2 and 60% on C-17**

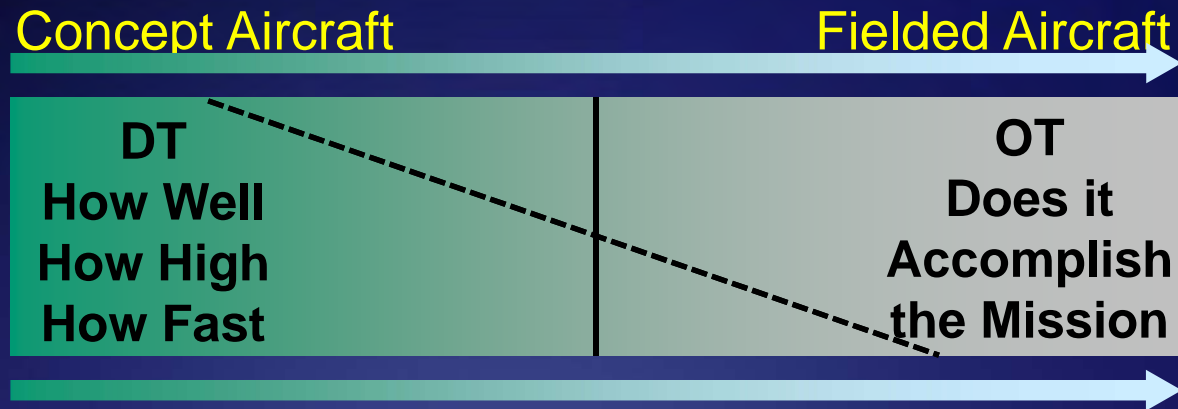
“In addition, planned testing was curtailed to accommodate cost constraints on the overall program.”

\$



# Development and Ops Test

## An Opportunity to Save Time & Money



**Increasing cost to fix problems**

The faded line--less differences today...

- Use of Simulation for Ops Test
- Involvement of contractors in Ops Test
- More systems testing
  - Automatic systems
  - Effects analysis
- Decision systems--requirements matter far more than the operator

**Integrated Test, that melds all requirements, will save**



# Launching a New Program



**DILBERT** by Scott Adams



Science - Art -  
Discipline





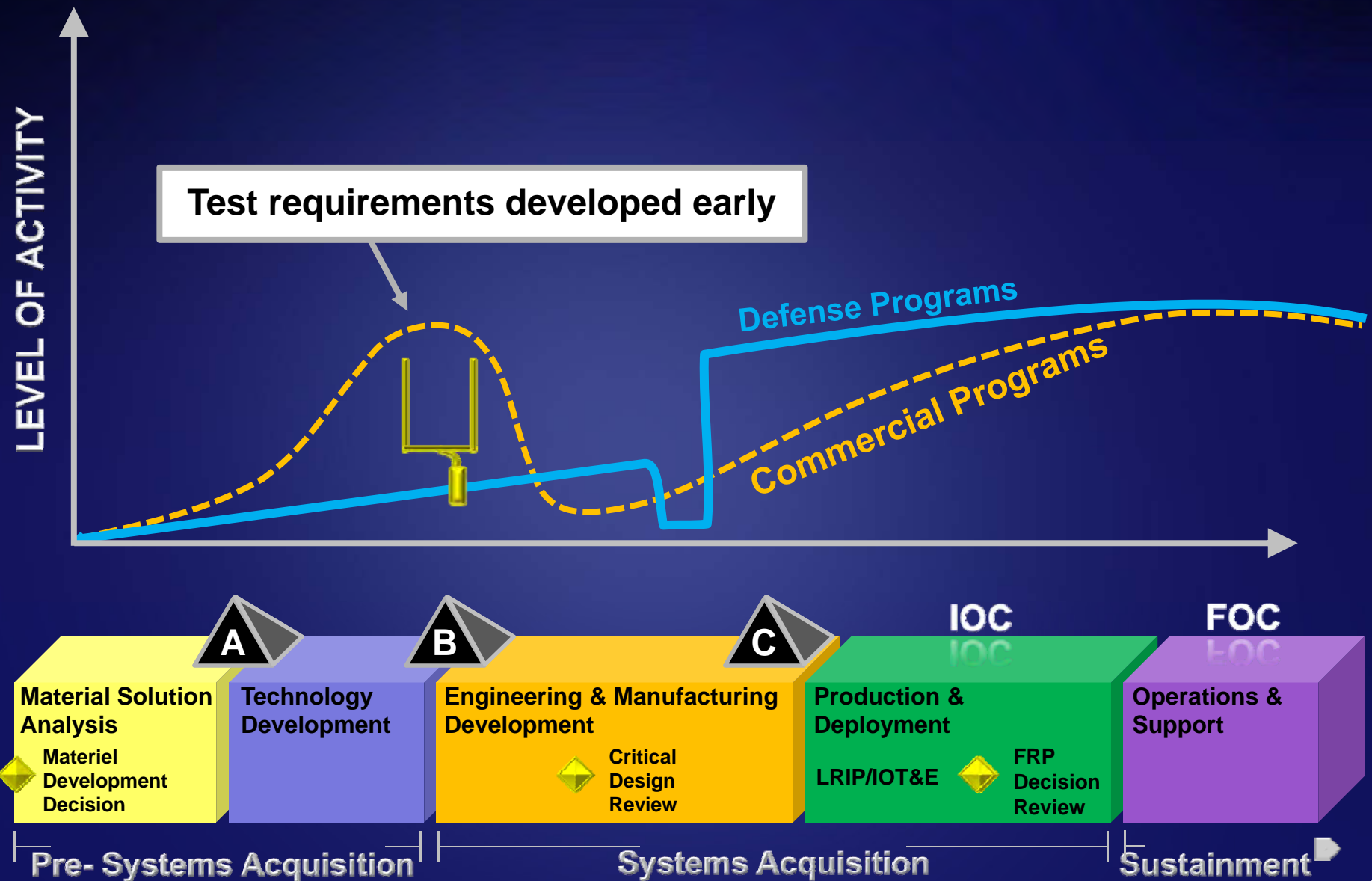
# Set Goal Posts Early



- **Contract Specifications**
  - **Ensure accountability**
  - **Encourage true partnering with government as lead**
  - **Ensures Open Book test**



# Setting the Right Goals





# Early Defect Discovery is Key



- Sooner a problem is discovered, the less it costs to
  - Fix
  - Develop work arounds
  - Cancel program



# Speaking Truth to Power



***We test to find / solve problems!***





# Early Program Optimism Is Natural



- Marketing
- “Operationally Acceptable”
- Little bit pregnant
- No deferred requirements
- “Solution Shops”

Realism has to set in...sooner or later

*Schedule behind you is like runway behind you...*  
*Test Early and Often to minimize risk*

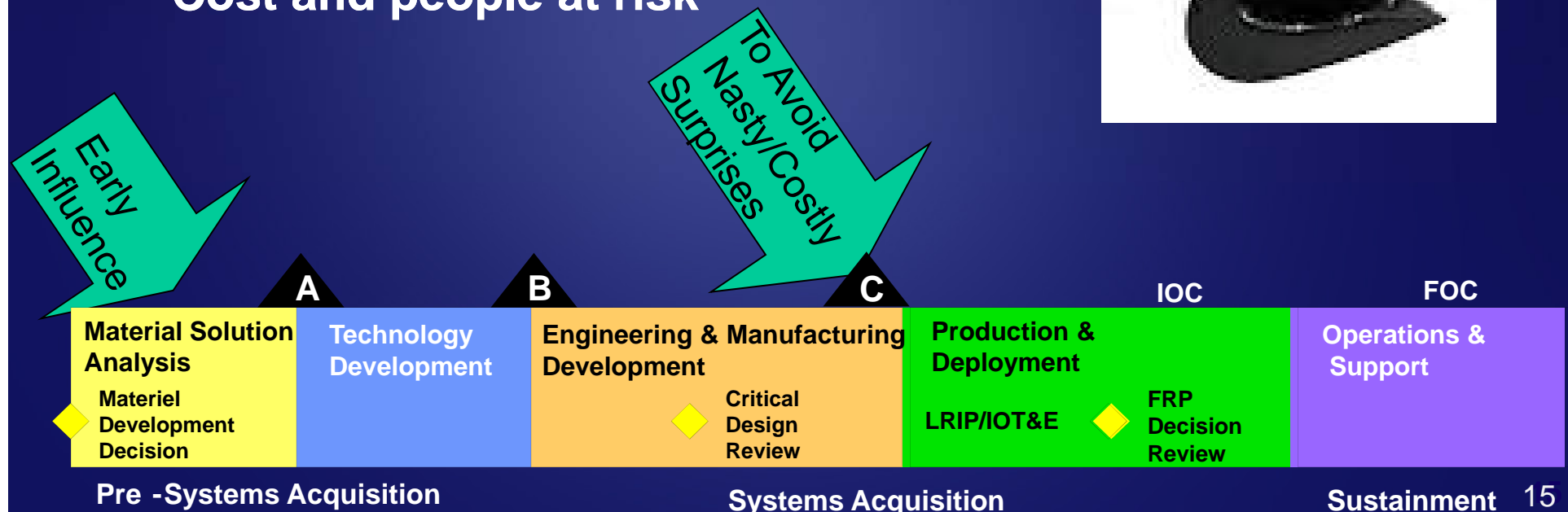


# Test Early...Test Often



- **Concurrency is more curse than blessing**
  - Stems from Rosy assumptions to save \$
  - Denial of problems
  - Over reliance on Modeling & Simulation / design tools
- **Risk Management**
  - Software vs hardware
  - Cost and people at risk

Black Hats?

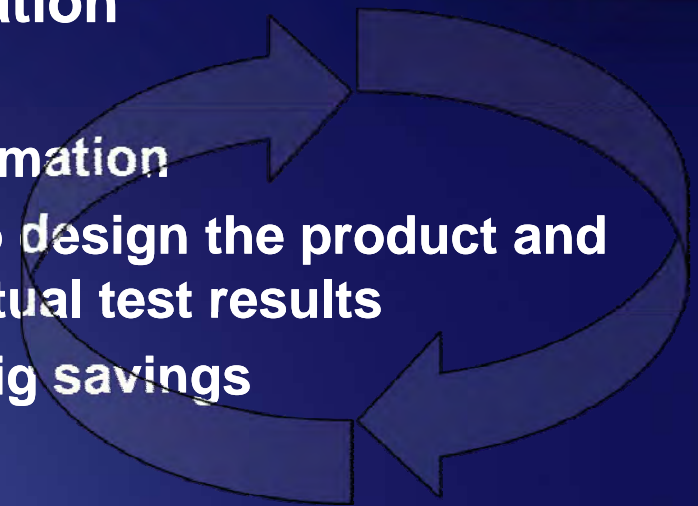




# Test: Your Partner in Successful System Development

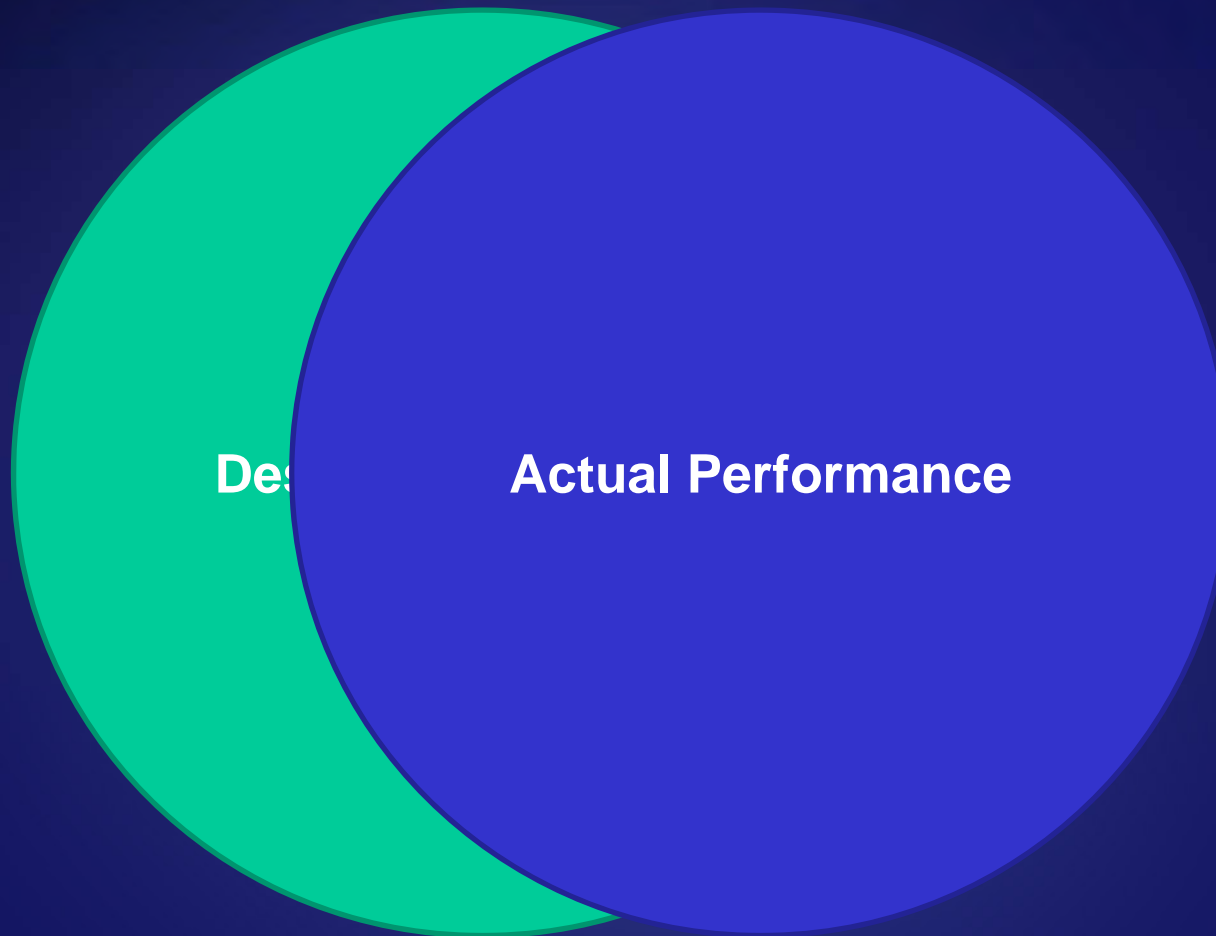


- **Over-reliance on Modeling & Simulation**
  - Garbage in – garbage out
  - Models only as good as known information
  - Circular logic when model is used to design the product and then used to test the product w/o actual test results
  - Won't find problems early – i.e. no big savings
- **Test and evaluation: integral to the development process**
  - Verifies and validates models
  - Measures actual system performance during development
  - Analytic (e.g. 5 test configurations versus 720)
  - Builds a robust, exploitable model





# Requirements vs Reality







# Test as Part of Development



- The target / weapon combination is dominant
- Weapons / systems have incredible autonomy

- *Test to Integrate*
- *Test to Develop*

Typical Program Cost Pie

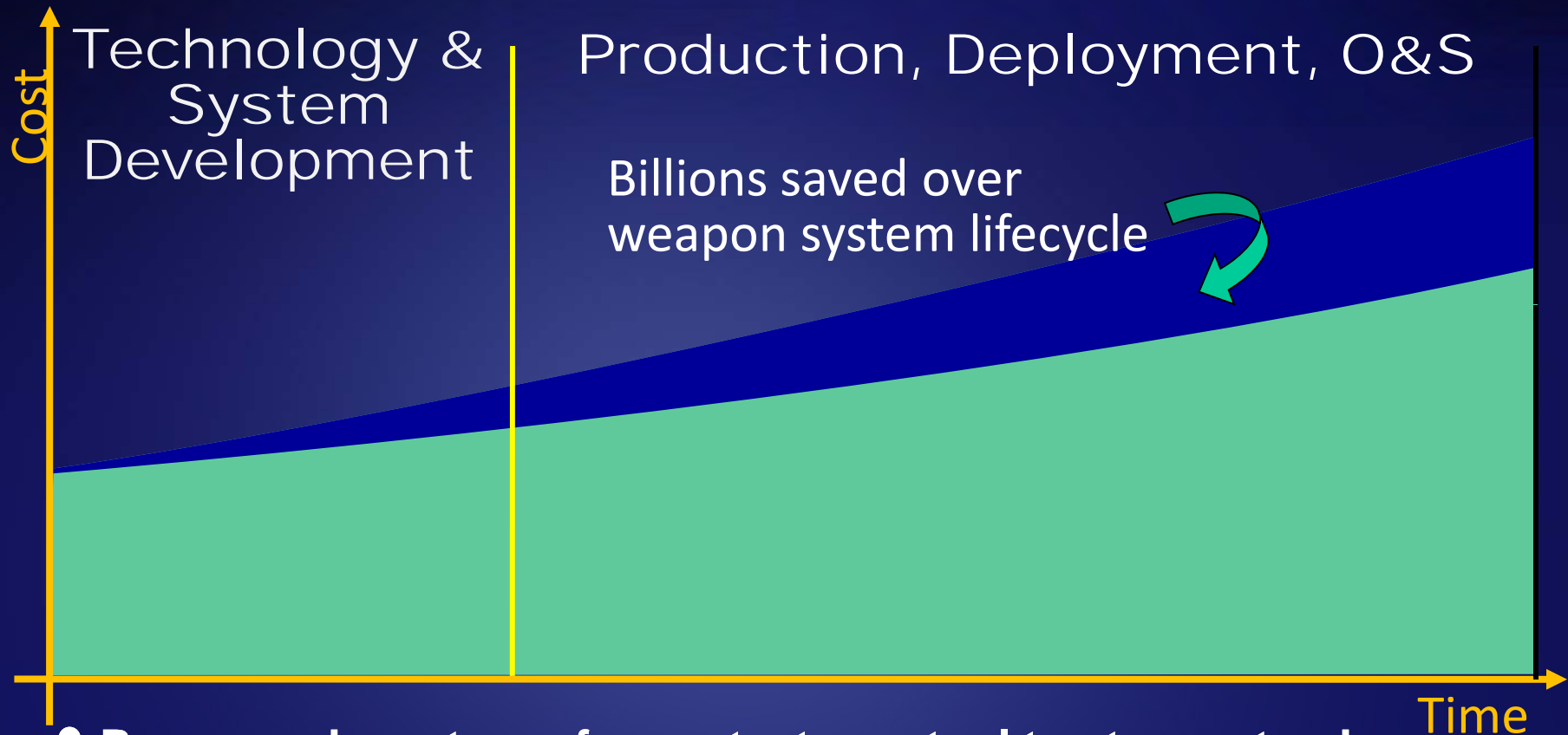


- Development
- Integration
- Test (separate?)
- Other

- Decision Systems/Displays must be deemed user friendly or *hostile* – *Task Friendly Not Just Adequate*
  - *Defined task and Actionable Displays*
  - *“Unique training” closely scrutinized*
- The need for Truth – *Fair and Balanced*
  - *Tedious is tedious while agile is agile (esp. with s/w)*
  - *Easy, precise and timely is the minimum today*



# Early Test >>> Later Test Return on Investment



- Programs have to perform – test as a tool to stay on track
  - Either cost avoidance (prevent the overrun) or pure cost savings

# Perspective:



**Everybody lies.**



# Evils (Costs) of Concurrency

(i.e. Rushing It to the Field)



- 64 aircraft built early in the aircraft's production run will require modification to achieve their full flight-hour design lives
  - Engineers identified a shortfall with a structural component in their wings
  - During recent full-scale durability testing, a crack emerged that was consistent with the analytical predictions
  - Must retrofit plans 64 early aircraft
  - Durability testing helps identify structural issues early on "to avoid costly sustainment issues later in the life of the aircraft."







**“It was fine...until we got into test.”**



Cost of OT is a relatively small portion (~1%) of the overall program budget, it is a large portion of the budget in the year it occurs. By virtue of being at the end of the development process, testing occurs when the program has few degrees of freedom left to work issues, including a checkbook with little reserve

Design (test)...Build(test)

Versus  
Buy...Fly...Fix



# Development / Fielding Problems



- Unless your “child” is fully grown, he/she has a lot to learn
- As members of the system acquisition team, problems are expected – nothing is perfect
  - Hardware will fall short
  - Software will glitch

**“Why man, I have gotten a lot of results. I know several thousand things that won't work.” Thomas Edison**



# Testing Concerns

- Independent team assessed concern:  
testing drives undue requirements, excessive cost and added schedule
  - Examined 40 programs with significant delays
    - 7 experienced some delay (not primary) due to testing
    - 37 programs: problems discovered during test caused much longer program delays than test itself
- DOT&E review of 76 programs
  - cost of OT&E ~1% of total acquisition cost



**Result: Testing alone does not cause major program delays or cost increases**

j3

Another idea for "37" bullet:

-37 progams: problems discovered during test caused much longer program delays than testing itself

jeffrey.olinger, 6/8/2011





# Paradigm: Quickly to the Warfighter!



- Just get it to the user (*sometimes* absolutely necessary)
- Regardless of specification shortfalls – “the contractor did their best”
- The User will determine what system can be used for
  - creating the need for user testers
- Late identification of deficiencies
  - Difficult holding the contractor accountable
- Generates new requirements
  - Fix this and that
- Increases program life cycle cost

**“Just because a thing doesn’t do what you expected, it doesn’t mean it’s worthless.” Thomas Edison**

**But can we afford it?**



# Hmmmmm



- Program is declared “ready for OT”
  - Contractor test data insufficient to determine spec compliance
  - Developmental testing was incomplete and resource limited
    - Insufficient time to complete data analysis
    - Limited database lowered RM&A prediction confidence
  - Open Cat 1 DRs
- OT performance concludes Not Effective / Not Suitable

***Is DoD asking for what it really needs?***



# Relevancy with Politics

## (Fixes Come Late, thus Cost More)



### Global Hawk Block 20/30 Initial Operational Test and Evaluation (IOT&E)

- IOT&E Findings are Generating Multiple Program Improvements

- NGC is working with USAF to **proactively address** findings
- ASIP and Reliability & Maintainability key areas of focus...Planning USAF/NGC ASIP Technical Meetings
- Generator solution indicative of positive teamwork

- Improvements Already Evident

- Deployed Block 20/30s are performing quite well ahead of IOC declaration...90% Mission Effectiveness 225 Missions with over 4,300 hours
- Expect DoD Full Rate Production and IOC in Sept 2011

Deficiency	Corrective Action Initiated
Clickbond Nutplates	✓
25 kVA Generator Failures	✓
Kearfott Navigator Issues	✓
Sensor Management Unit (SMU)	✓
Integrated Sensor Processor (ISP)	✓
Common Airborne Modem Assembly	✓
GMS Control Panel (GCP)	✓
Main Landing Gear (MLG) Wheels/brakes/tires	✓
Engine Fuel Nozzles	✓

- These nine deficiencies comprise 81% of all failures during IOT&E
- Several of deficiencies have been completed

Team Proactively Addressing IOT&E Findings with USAF  
*Results evident in Real World Operations*



# Objectivity and Accountability



- **Objectivity is #1 goal**
  - Credibility comes from Objectivity
  - Objectivity (generally) comes from Independence
  - Developing / fielding capability is the priority
  - Technological success is a precursor
- **Accountability is critical**
  - Government sets expectations
  - Contractor needs clear direction
  - Nothing is perfect and what gets fixed versus what gets lived with is a government decision
- **Resolution is a total team effort**





# Best Practice: A More Constructive Test Approach is Key to Better Weapon Systems (GAO Report - July 2000)



- “Commercial firms have found constructive ways of conducting testing and evaluation to help them avoid being surprised by problems late in a product’s development.”
- “However, the pressures of successfully competing for [government] funds to start and sustain a weapon system program create incentives for launching programs that embody more technical unknowns and less knowledge about the performance and production risks they entail...a new program will not be approved unless its costs fall within forecasts of available funds.”

\$



# Best Practice: A More Constructive Test Approach is Key to Better Weapon Systems (GAO Report - July 2000)



- “These Pressures and incentives explain why the behavior of [government] weapon system managers differs from commercial managers. Rewards for discovering and recognizing potential problems early in a DoD program are few. In contrast with leading commercial firms, not having attained knowledge – such as on the performance of a key technology – can be perceived as **better** than knowing the problems exist. When valid test results are not available, program sponsors can **assert projected performance.**”

“Accordingly, DoD testers are often **seen as adversaries** to the program.”

\$



# DoD's High Risk Areas

GAO Report, 12 Mar 09



**“Ultimately, the process produces more demand for new programs than available resources can support, promoting an unhealthy competition for funds that encourages programs to pursue overly ambitious capabilities, develop unrealistically low cost estimates and optimistic schedules, and suppress bad news.”**

**Proper DoD leadership to offset  
this pressure is essential**

***Testing doesn't cost, it pays!***



# Mission, Business, Politics



- Government must integrate
- We need capabilities to execute our mission
- Getting those capabilities to execute our mission is business; industry has to make a profit
- Politics trumps mission and business
  - every dime comes from Congress
- As budgets shrink drastically, we need to shift the paradigm to better “inside the box” thinking





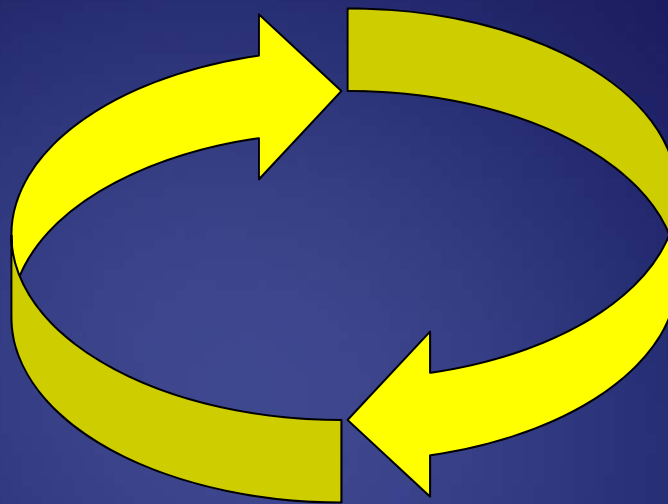


# Summary



- The value in test is its potential to reduce bad decisions
- If bad news is avoided – bad decisions will follow
- Relationships are key to savings and success
- Government & Industry both need to insist on clear executable specs/standards
- The government has to lead/direct as the buyer / user
- Need to get Back to Basics
  - Write contracts with enforceable specs (not a bad thing)
  - Stop systems going to the field before they are ready
- Don't marginalize the Acquisition and Test Community
  - Critical role and mission to perform (\$ to be saved)

***Testing doesn't cost, it pays!***



***Testing doesn't cost, it pays!***



# Punish the Innocent



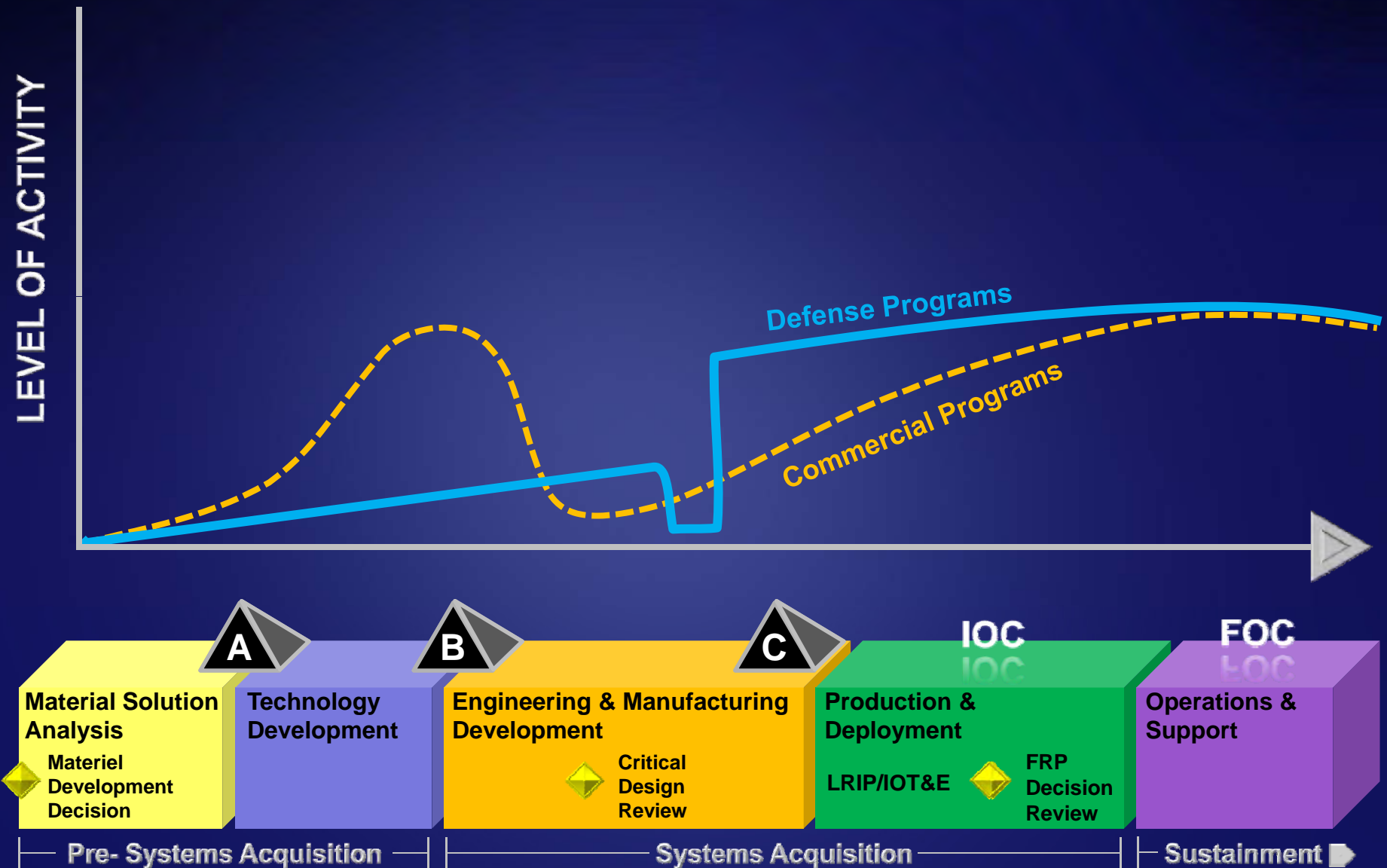
## Dilbert



[www.dilbert.com](http://www.dilbert.com) [scottadams@aol.com](mailto:scottadams@aol.com)



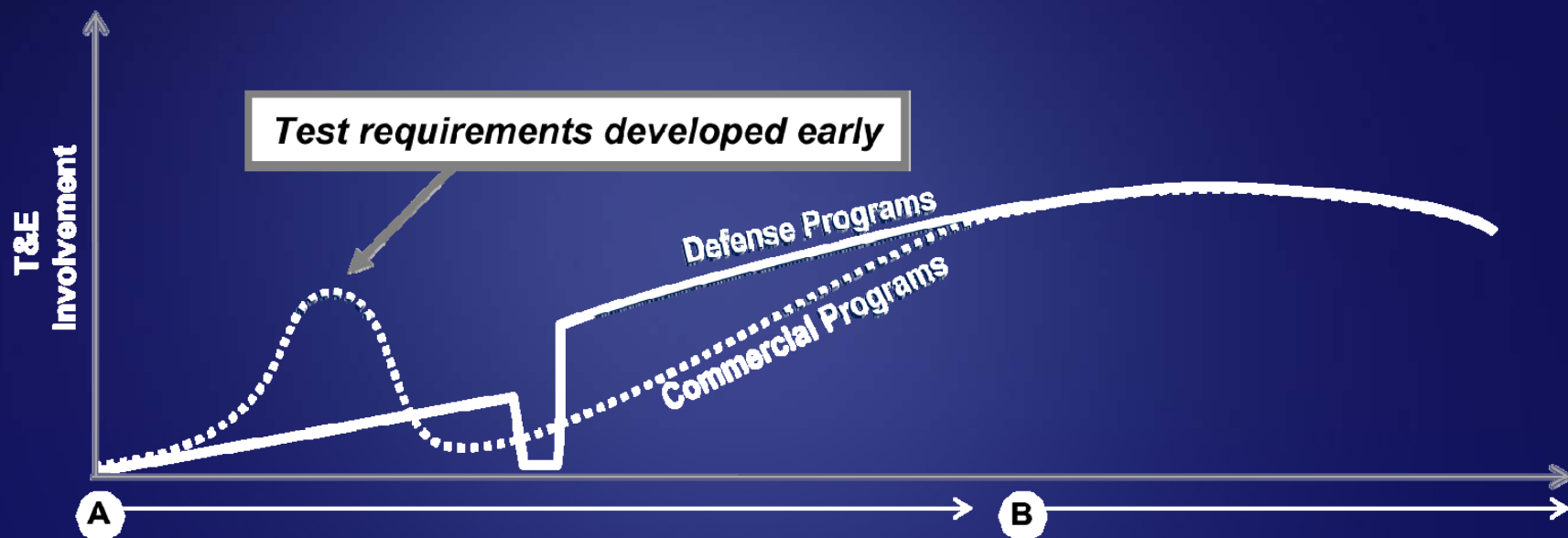
# Setting the Right Goals







# Test Requirements and Program Lifecycles



**Test Requirements development effort and influence varies  
Between Commercial and Military programs.**



# Hope versus Reality

## Time for Defect Discovery and Solution



- **F-22**
  - 4 year program
  - took ~8 years
- **B-2**
  - 4.5 years, 3,000 hrs, program
  - Took 8 years, 5,000 hrs
- **F-35 (15 a/c, 7 ground test articles)**
  - 7 year, 11,000 hrs, 6,000 flights
  - 22M LOC
  - Schedule to complete development?



# Bureaucratic or Effective?



- **Ben Rich, Skunk Works**
- **CIA Agent's View**
- **Contractor versus Government Test**
  - Interviewing lawyers
  - Message management & the B-1B, etc.
- **2000 GAO View**



# JOINT STRIKE FIGHTER

Restructuring Places Program on Firmer Footing, but Progress is Still Lagging Overall

**“After more than 9 years in development and 4 in production, the JSF program has not fully demonstrated that the aircraft design is stable, manufacturing processes are mature, and the system is reliable.”**

**“Engineering drawings are still being released to the manufacturing floor and **design changes** continue at higher rates than desired. More **changes** are expected as testing accelerates.”**

GAO March 2011

**Test budgets are puny.  
Schedule slips and design changes cost big bucks.**



**2EO STRI**

# **Introduction to the Army Common Control System (ACCS)**

**Barry Hatchett**

**Lead Project Director**

**Targets Management Office (TMO)**

**COM 256-842-6797,**

**DSN 788-6797**

**[Barry.Hatchett@us.army.mil](mailto:Barry.Hatchett@us.army.mil)**





# Targets Management Office



## Outline

- Overview
- Transition
- Capabilities
- Schedule
- Teaming Efforts
- Summary



# ACCS Overview



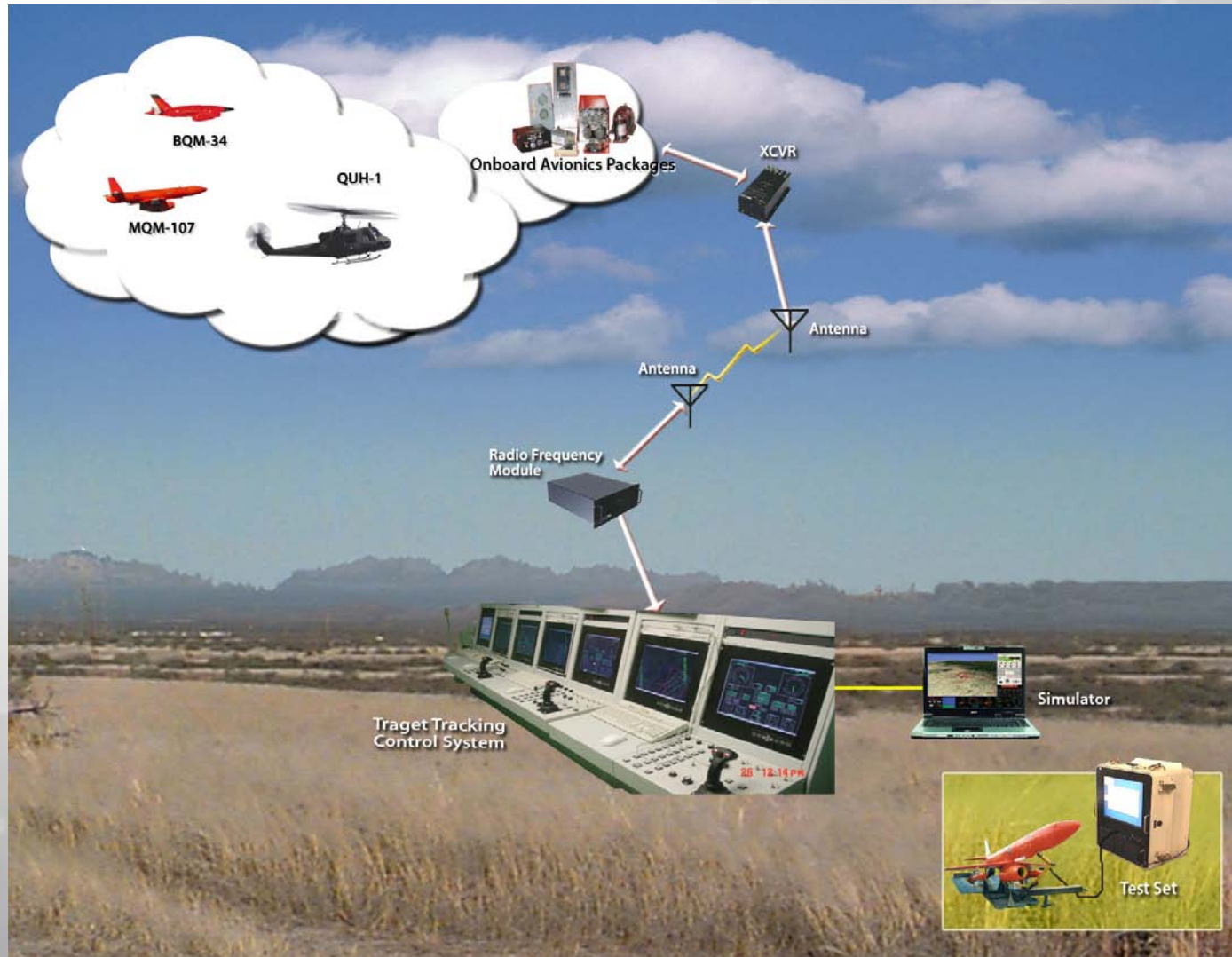
- Army target control system for TMO aerial and ground targets
- Leverage the current Target Tracking Control System (TTCS), vehicle avionics, and test set technology
- Meets DoD Information Assurance Certification and Accreditation Process (DIACAP)
- ACCS will be the primary rotary wing, ground target, and subscale aerial target control system for Army



ACCS Concept



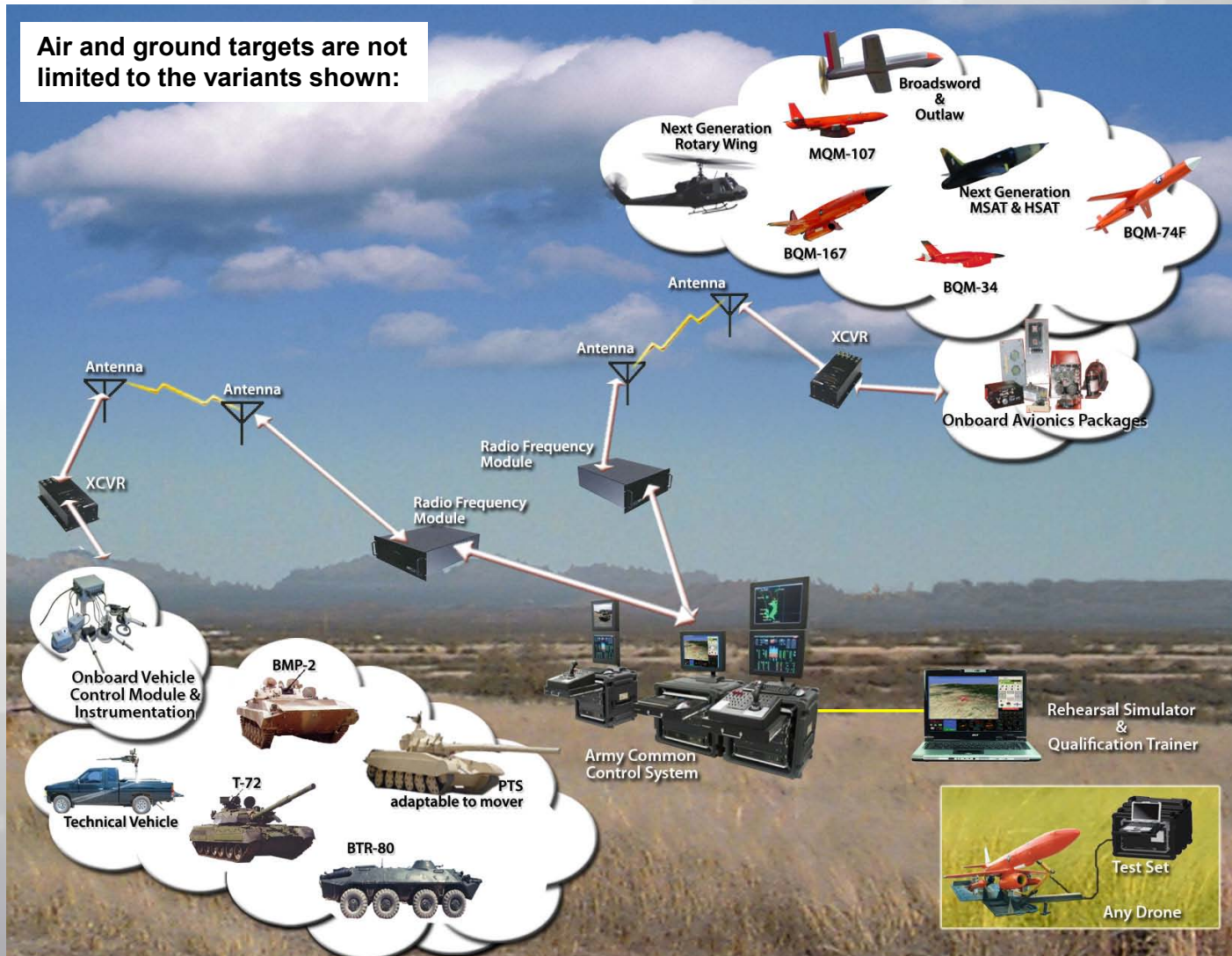
# Existing Target Tracking Control System (TTCS) OV-1





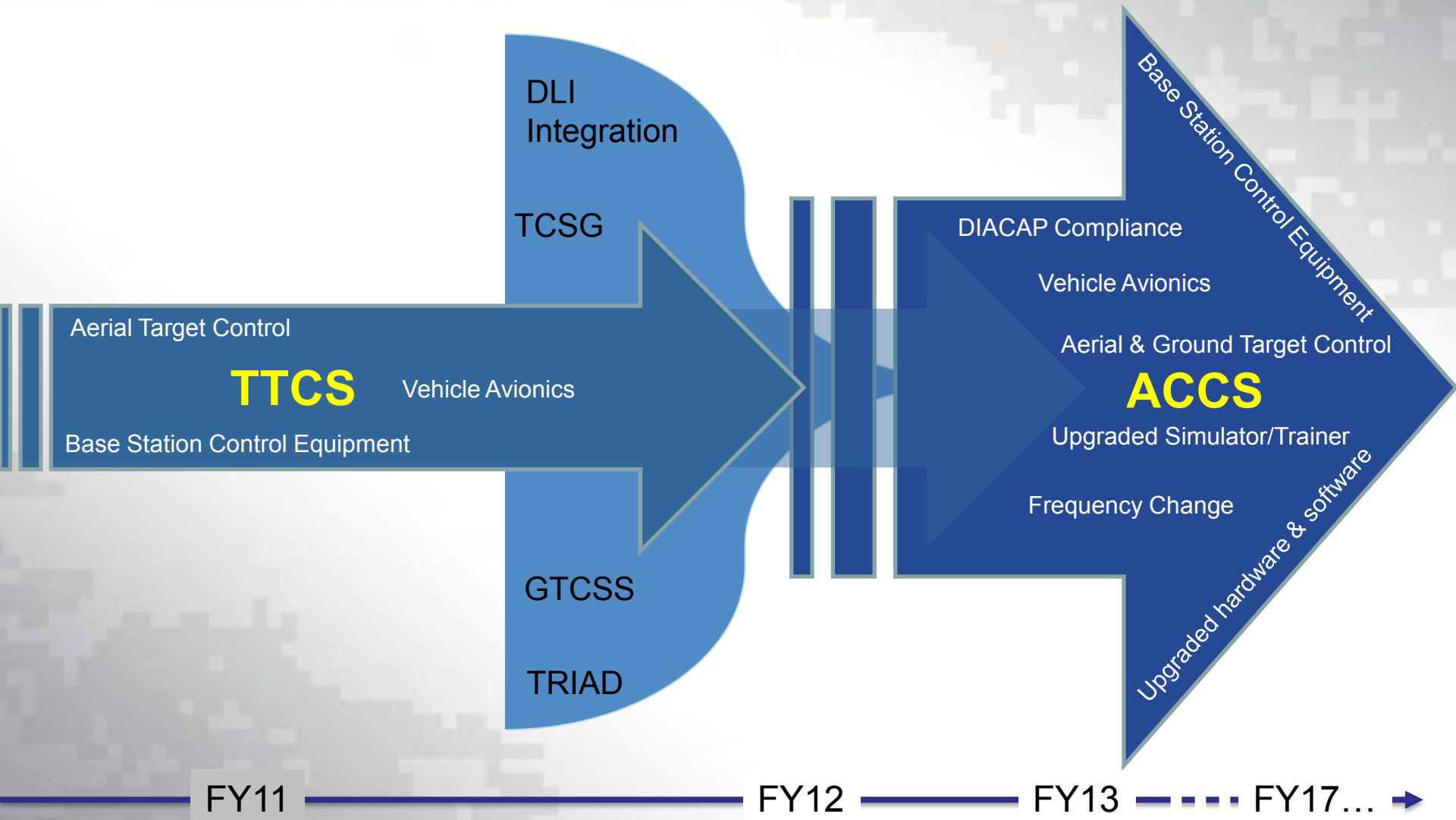
# ACCS OV-1

Air and ground targets are not limited to the variants shown:





# Way Ahead







# Targets Management Office



## ACCS Capabilities

### Aerial Target Control

- Provide control of up to 8 airborne targets simultaneously
- Support 2 targets on a single Data Link frequency
- Direct mode (1 target @ 10 Hz or 2 targets @ 7 Hz)
- Target Relay mode (1 target @ 6.5 Hz or 2 targets 4.5 Hz)
- Dedicated Relay mode (1 target @ 5 Hz or 2 targets @ 3.7 Hz)
- Provide GPS differential corrections to the targets (target dependent)

### Ground Target Control

- Control of tracked and wheeled vehicles
- Waypoint movement, GPS guidance
- Collision avoidance
- Control of vehicles in formation



# Existing Ground Target Locations and Control Systems



ITT developed control system

Central Asset Pool (CAP)  
(Spares/Float) (YPG)

Yuma PG, AZ

In house developed control system

WSMR, NM

Eglin AFB, FL  
AFDTC

SRTGT & In house developed control system

Redstone Arsenal, AL

Kairos Autonomi developed control system

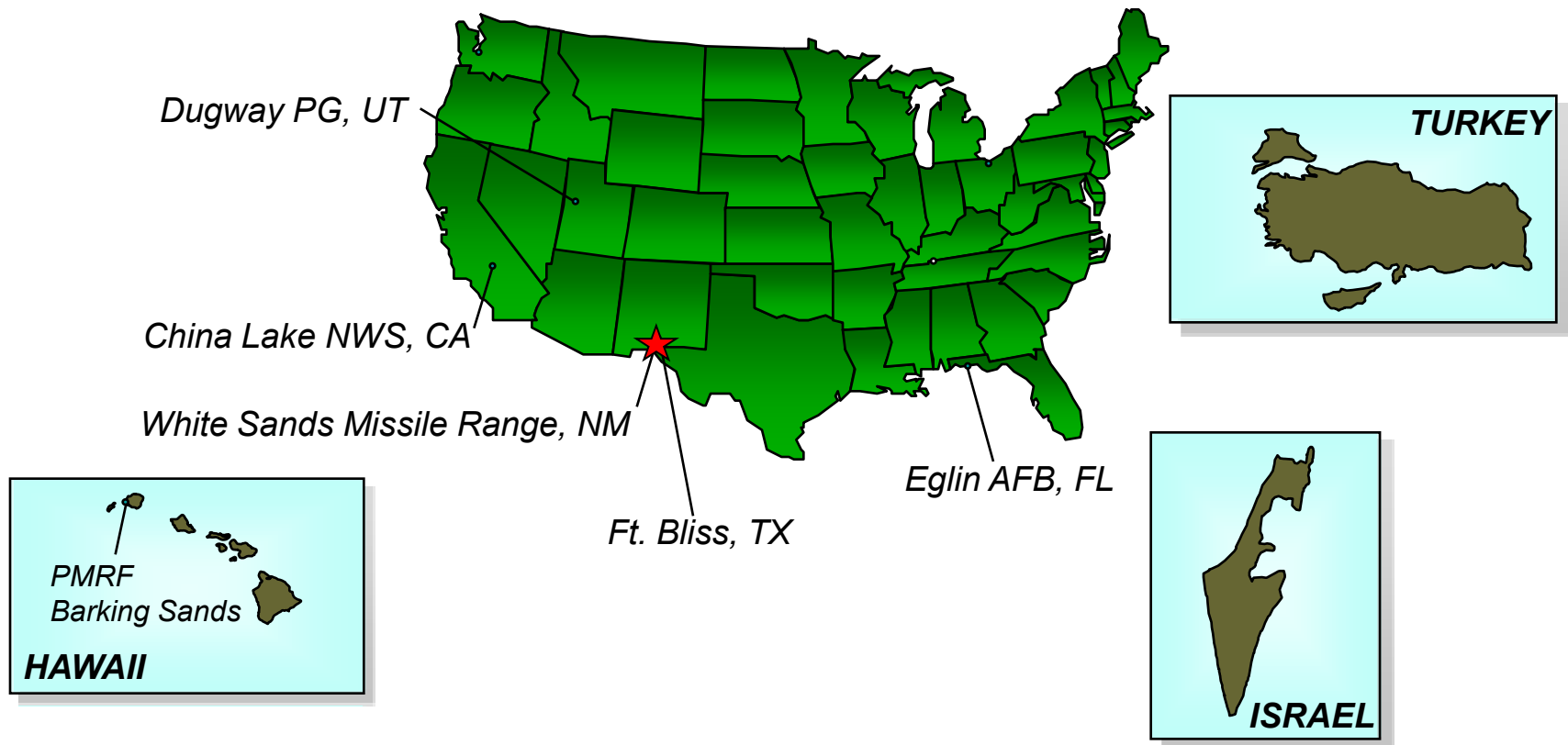
Aberdeen PG, MD

In house developed control system

**Each system is independently developed and operated**



# TMO Aerial Target Operating Locations

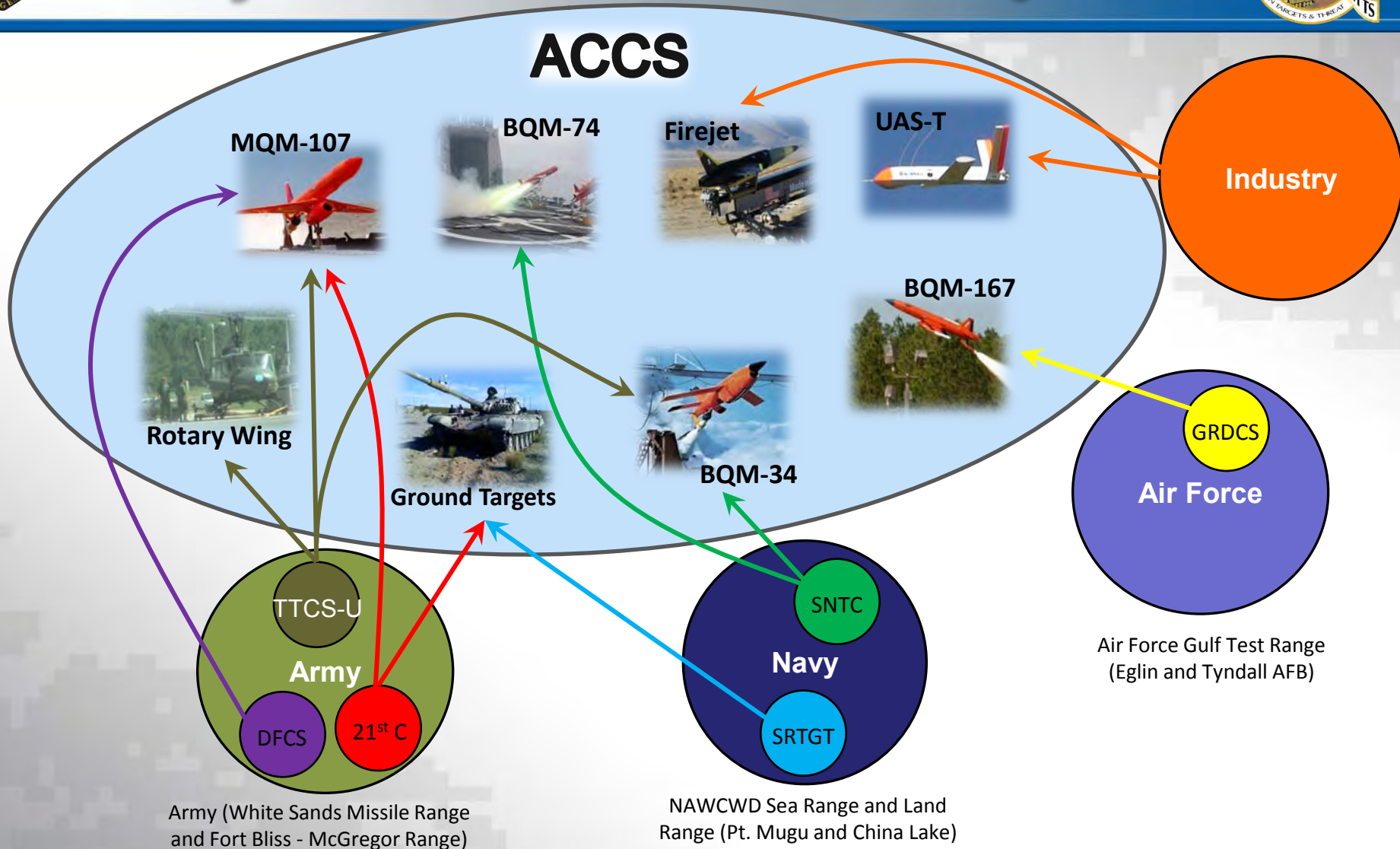




# Army Common Control System



## ACCS

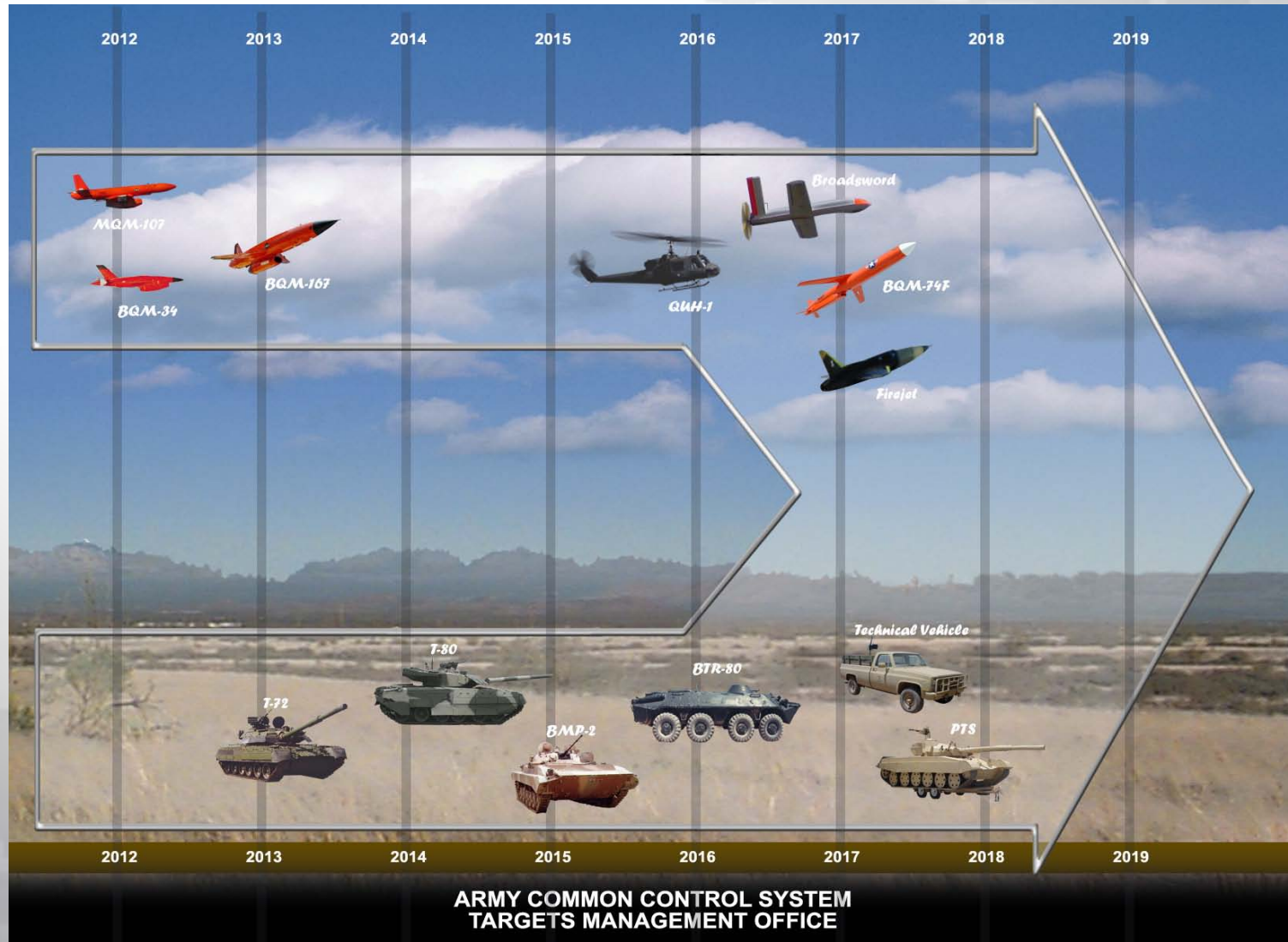


**Leveraging existing technology to develop the control system for targets of the future**





# ACCS Schedule



## Concepts



Fixed Site



Rack Mounted and  
Portable Hardware

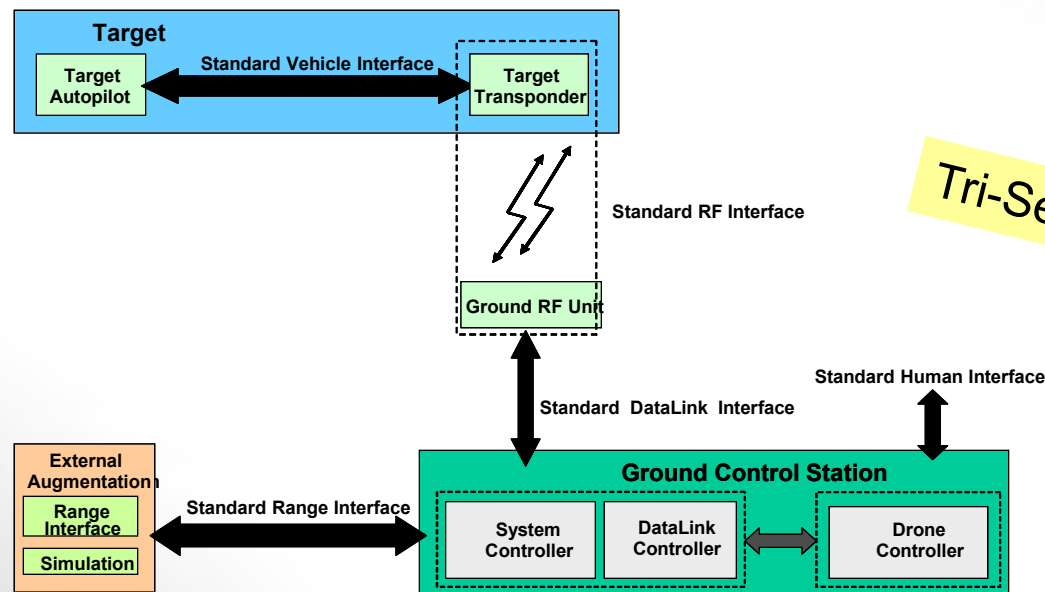
Portable Test  
Set





# Target Control Steering Group (TCSG)

- Navy lead Office of the Director, Operational Test and Evaluation (DOT&E) Target Management Initiative (TMI)
- Standardize data interfaces between ground control system, ground radio frequency unit, and target transponders



Tri-Service Initiative

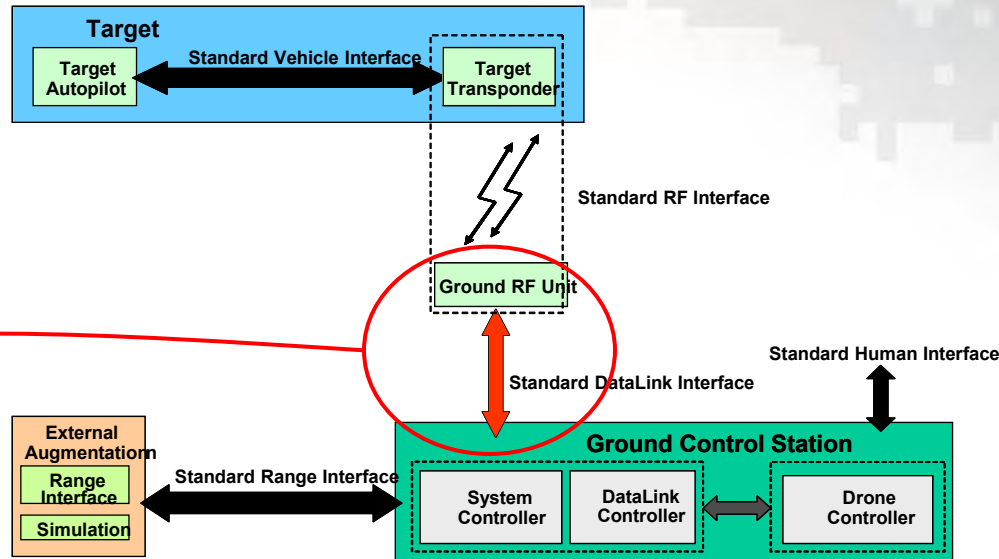
- Increase interoperability between all services control systems

**Goal : Control Any Target with Any Ground Station**





# TCSG Data Link Interface (DLI) Integration



- Review DLI for Integration into the Army control system
- Integrate the DLI natively into the control system
- Perform factory qualification tests to certify the DLI integration for field ground testing
- Update user manuals to support field tests
- Conduct required flight test





# Targets Management Office



## Summary

- ACCS starts in FY12
- ACCS will meet DIACAP
- Provides Aerial and Ground Target Control across multiple ranges
- Incorporates all TMO T&E Targets into a Single Control System
- Upgrades Hardware and Software for Avionics Packages, Test Sets, and Control System
- Incorporates the standard DataLink Interface developed as part of the TCSG TMI



# **Joint Interoperable TCS Standard Interfaces**



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## **OSD DOT&E Target Control Steering Group (TCSG)**

### **Standard Target Control System Interfaces**

**26 October 2011**

**Dae Hong**  
**Head Target Systems Division**  
**NAWCWD 53100ME**  
**(805) 989-5996**  
**[dae.hong@navy.mil](mailto:dae.hong@navy.mil)**



# Joint Interoperable TCS Standard Interfaces

## Outline

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- Introduction
- Program Description
- Technical Status
- Standard Interface Demonstration
- TCSG Path-Ahead Summary



# Joint Interoperable TCS Standard Interfaces



## Introduction

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The Army, Air Force and Navy have their ground control stations that operate on their Training and T&E Ranges.

The data interfaces between the Ground Target Control System, Ground RF Unit, Target Transponder and Range infrastructure are different for each service.

This has created interoperability issues. Targets are closely coupled with the ground control system and the use of targets across ranges is limited.

This program is to develop Tri-Service Standard Interfaces to reach interoperability by developing hardware independent interfaces for the Ground Target Control System, Ground RF unit, Target Transponder and Range Infrastructure.



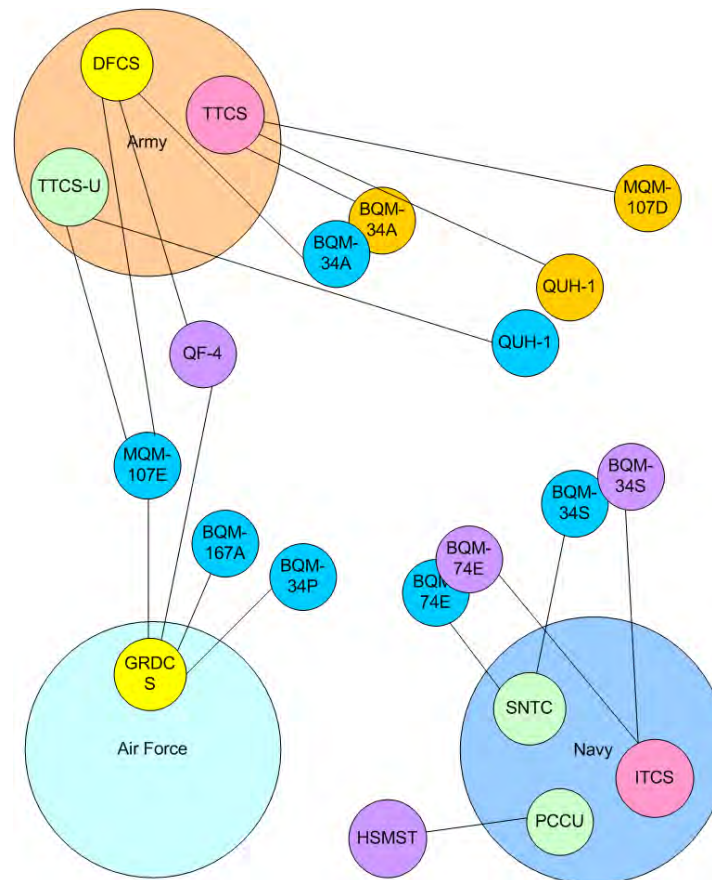


# Joint Interoperable TCS Standard Interfaces

## Introduction



### Target Control Systems and Targets





# Joint Interoperable TCS Standard Interfaces

## Program Description

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- Goal
  - Achieve the 2005 Defense Science Board Report’s vision of “the gradual introduction of common control elements into each range to provide an increasing degree of interoperability, test flexibility, and lower operational costs.”
  - **Control Any Target with Any Ground Station**
- Target Control Steering Group (TCSG)
  - TCSG is a tri-service group with the mission to identify common control elements at key points in the Target Control System (TCS) architecture
  - OSD/DOT&E Memorandum Chartered the TCSG through the Target Management Initiative (TMI) in August 2007.
    - Prior to that TMI received 21 requests in excess of \$16M for stove-pipe TCS related enhancements
  - Held Regular Technical Interchange Meetings (TIMs) to discuss Interfaces, review Target Control Systems, and discuss Architectures (OSD, WSMR, NBVC-Pt. Mugu, Tyndall AFB, TRMC, DOT&E)
    - Held 11 TIMs to-date



# Joint Interoperable TCS Standard Interfaces

## Program Description

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- Reviewed and evaluated industry existing standards for reuse and concepts
  - TENA
  - JAUS
  - STANAG 4586
  - CAN/CDA
- Services have Similar Target Control Architectures:
  - Generic PC H/W platform in most systems
  - H/W dependent Control panel and RF Radio
- Services are Evolving to be Platform Independent
  - All Services using PC platform
  - Industry Standard Interfaces for control panels and manual control
    - USB2
    - Ethernet



# Joint Interoperable TCS Standard Interfaces

## Program Description

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- Standard Interfaces provide methods for target control systems to communicate together
  - Provides a path for commonality of message types and definitions to reduce redundant data type
  - As systems and targets evolve, standard interfaces provide a path for interoperability
- Joint Interoperable TCS Standard Developed
  - Identified Primary Interfaces
  - Agreed to Five Interfaces to be Addressed
  - Prioritized Interfaces for Standardization





# Joint Interoperable TCS Standard Interfaces

## Program Description

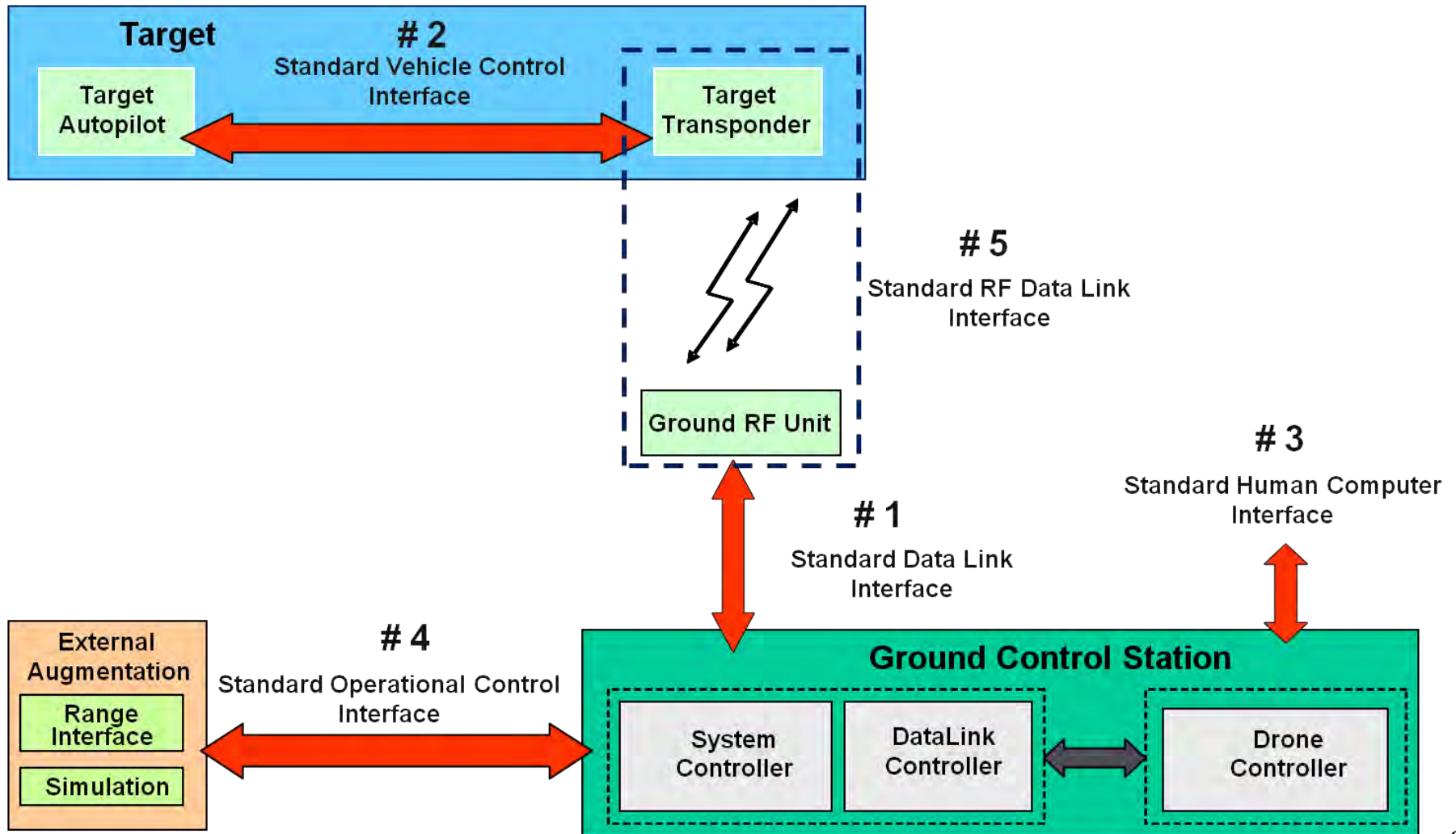
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- Target Control Steering Group (TCSG)
  - Identified common elements: five Independent Standard Interfaces in priority order
    - 1) Data Link Interface (DLI)
    - 2) Vehicle Control Interface (VCI)
    - 3) Human Computer Interface (HCI)
    - 4) Operational Control Interface (OCI)
    - 5) RF Datalink Interface (RF DLI)
  - Interoperable capabilities are achieved when Services implement one or more standard interfaces. i.e.
    - DLI Standard – interoperable Target Ground Control System and TCS ground RF units
    - VCI Standard – interoperable Target transponders
    - With each Standard Interface implemented, interoperability reached at the point of implementation
- Recommended Electrical Interfaces for QF-16 (Jan 2008)



# Joint Interoperable TCS Standard Interfaces Program Description





# Joint Interoperable TCS Standard Interfaces

## Technical Status

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- Released Joint Interoperable TCS Standard Interfaces
  - Data Link Interface (DLI), V1.0
  - Vehicle Control Interface (VCI), V0.3
  - Human Computer Interface (HCI), V0.1
  - Operational Control Interface (OCI)
    - Investigating the use of TENA
  - RF Data Link Interface (RFDLI)
    - Investigating a Navy proposal
- Key Issues and Critical Actions Accomplished
  - All stakeholders briefed (June-August 2008)
    - Army, Navy, Air Force, TRMC, DT&E, and DOT&E
  - Flight Demonstration program for Standard DLI began in FY09
    - New Common Target Control System, CTCS, system was developed to demonstrate Standard Interface in native format
    - Army Target Tracking Control System, TTCS, was chosen to demonstrate interoperability of Standard and legacy interface



# Joint Interoperable TCS Standard Interfaces

## Standard Interface Demonstration

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- Completed three successful DLI Demonstration flight tests
  - New Common TCS with Navy BQM-74E
    - Standard TCS Data Link Interface
    - Flight Test: 28 October 2009
  - New Common TCS with Navy BQM-74E
    - STANAG 4586 Data Link Interface
    - Flight Test: 15 December 2009
  - Army TTCS/U with Navy BQM-74E
    - Standard TCS Data Link Interface with middleware
    - Flight Test: 21 June 2010



# Joint Interoperable TCS Standard Interfaces

## Standard Interface Demonstration

---



- Flight Test with Common Target Control System
  - Software and Hardware development and Ground Testing using the Navy BQM-74E Target, the Common Target Control System and the operational control room facilities has been satisfactorily completed.
  - The system successfully passed Environment and Electromagnetic Compatibility (EMC).
  - The Common Interface TCS was successfully demonstrated using the Standard Data Link Interface on 28 October 2009 at the Naval Air Warfare Center Point Mugu Sea Test Range.
  - A second flight demonstrating the STANAG 4586 data link was successfully flown on Tuesday 15 December 2009 at the Naval Air Warfare Center Point Mugu Sea Test Range.
  - There were no significant issues with the program.





# Joint Interoperable TCS Standard Interfaces

## Standard Interface Demonstration





# Joint Interoperable TCS Standard Interfaces

## Standard Interface Demonstration

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- **Flight Test with Army Target Tracking Control System – Ultra High Frequency, TTCS/U**
  - Completed Design of Reusable Middleware Components Implementing Standard Data Link Interface
  - Completed Design of TTCS/U Modifications
  - Completed Design of TTCS/U to Navy Target
  - Completed Integration of TCS Modifications, Middleware, and Target
  - A third flight demonstrating the Standard Data Link Interface with middleware successfully flown on 21 June 2010 at the Naval Air Warfare Center Point Mugu Sea Test Range.



# Joint Interoperable TCS Standard Interfaces

## Standard Interface Demonstration







# Joint Interoperable TCS Standard Interfaces

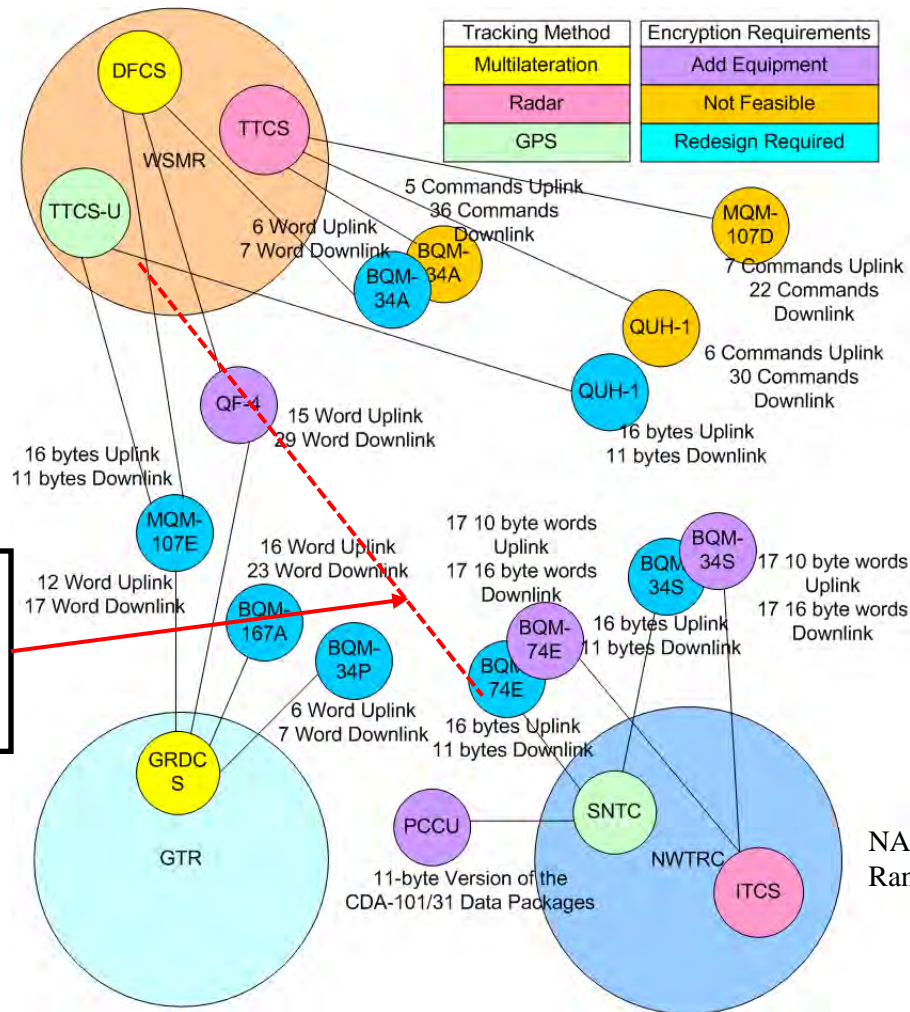
## Standard Interface Demonstration



Army (White Sands Missile Range and McGregor Range)

The DLI Demonstration used the DLI Standard Interface to enable an Army TCS to control a Navy BQM-74E

Air Force Gulf Test Range (Eglin and Tyndall AFB)





# Joint Interoperable TCS Standard Interfaces

## TCSG Path-Ahead Summary

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- Current TCSG Primary Effort:
  - Integrate the Standard DLI into prototype Army ATCCS
    - SRR Approved, 26 July 2011
    - PDR Approved, 20 September 2011
    - CDR: 24 January 2012
    - TRR: 15 July 2012
  - Both the Navy and Air Force participating with the effort and plan to review the results for application to their systems.
- Demonstrate Standard Vehicle Control Interface (VCI)
  - NAWCWD UAV targets include Standard DLI and VCI
  - DOT&E 5<sup>th</sup> Gen Target initiative planning use of Standard DLI and VCI
- Develop Certification Program
  - VCI certification program in trial
  - DLI certification program in development



# *Headquarters Air Combat Command*

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## *Air Combat Training Systems*



**Provided by  
ACC/A3AR  
AAC/EBYI  
Mr. Randall S. King**

**This Briefing is:  
UNCLASSIFIED**



# *Overview*

---

- **P5CTS Overview**
- **Baseline Program Description**
- **Fielding Status**
- **Retired Systems**
- **Debriefing Capability**



# P5 Combat Training System



## Specifications

**Participant datalink:** 80 nm (Air to Air)  
125 nm (Air to Grd)

**Data Link Relay:** 200 nm

**Accuracy:** 10ft x 10ft x 15ft

## Performance

**GPS based**  
**Rangeless**  
**Live Monitoring**

**RTKN/Wpn Sims**  
**Interoperable**  
- Link 16  
- FAA

## Aircraft

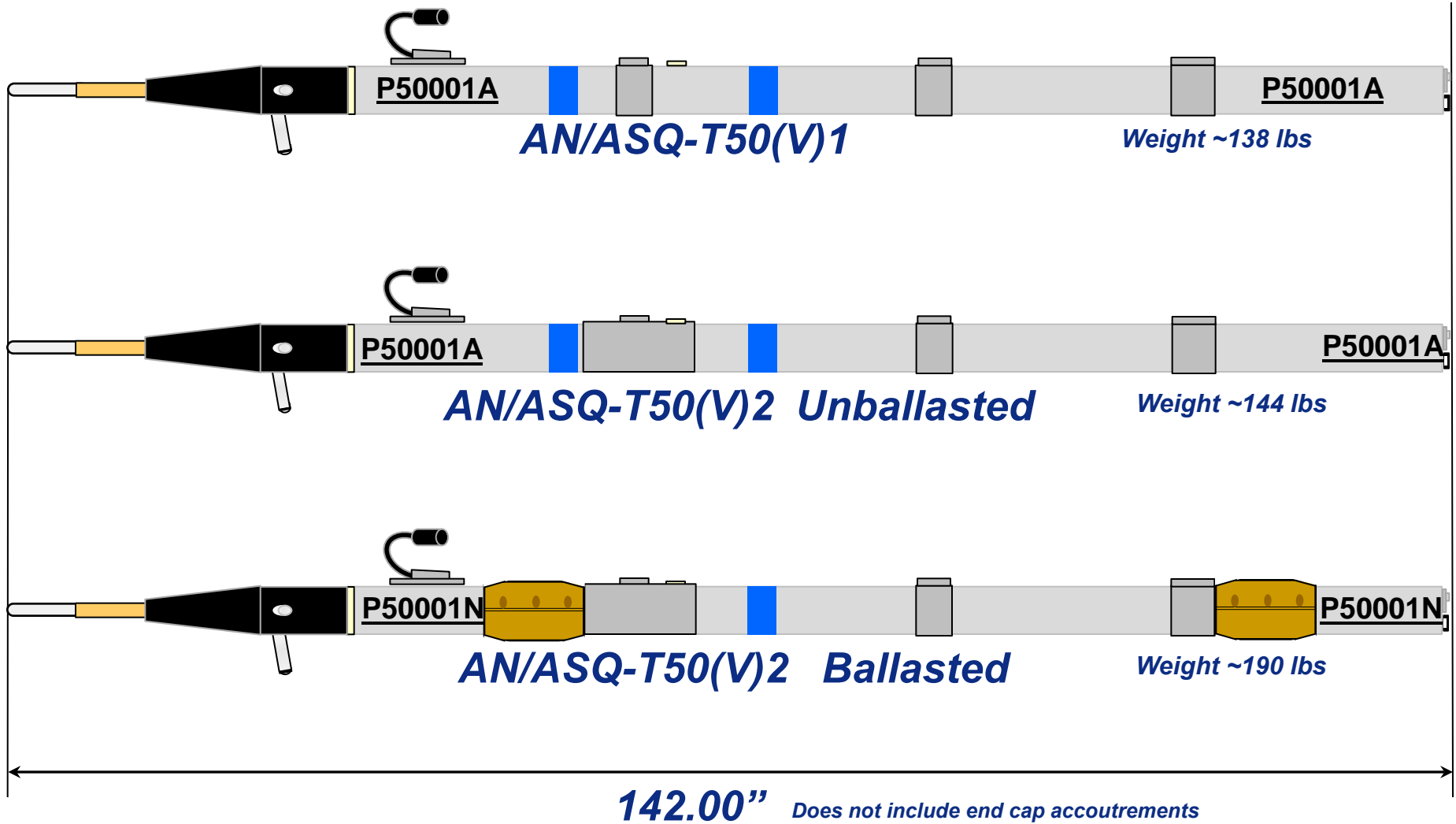
**F-15**  
**F-16**  
**A-10C**  
**F-18**  
**AV-8**  
**EA-6B**  
**F-5**

**Eurofighter**  
**EPAF F-16s**  
**Mirage**  
**Tornado**  
**SU-30**  
**AH-1**  
**UH-1**

**Provides Realistic Air Combat Training to the Warfighter**



# P5CTS/TCTS Pods





# Ground Subsystem

## Transportable Ground Subsystem (TGS)



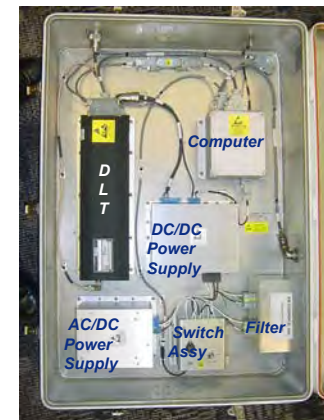
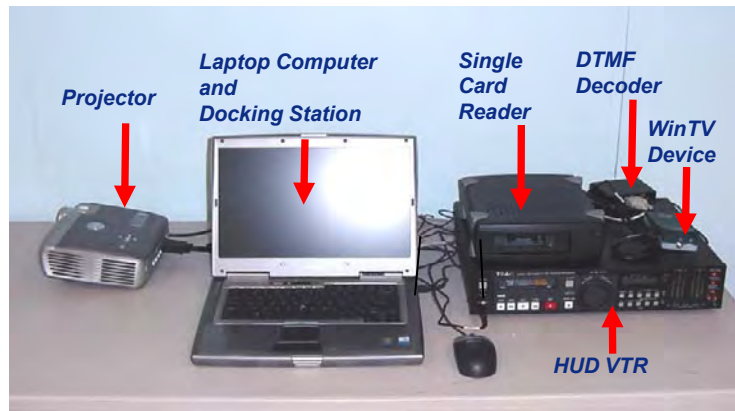
## Transportable Ground Subsystem w/Live Monitor - TGS/LM



TGS w/ LM comes with 1 RRU however additional RRU's may be added



## Portable Ground Subsystem (PGS)



## Remote Range Unit



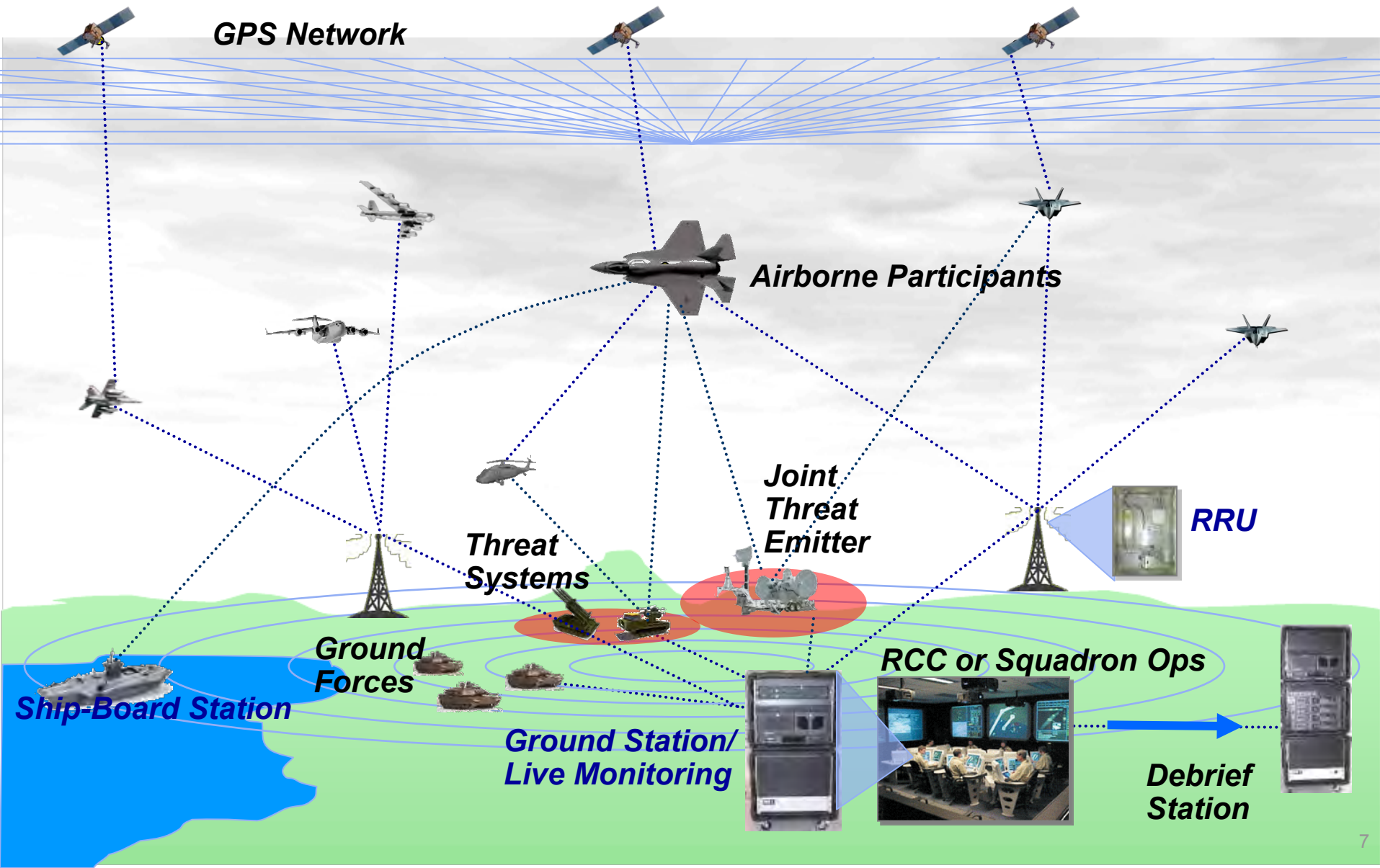


# Rangeless Operations P5CTS



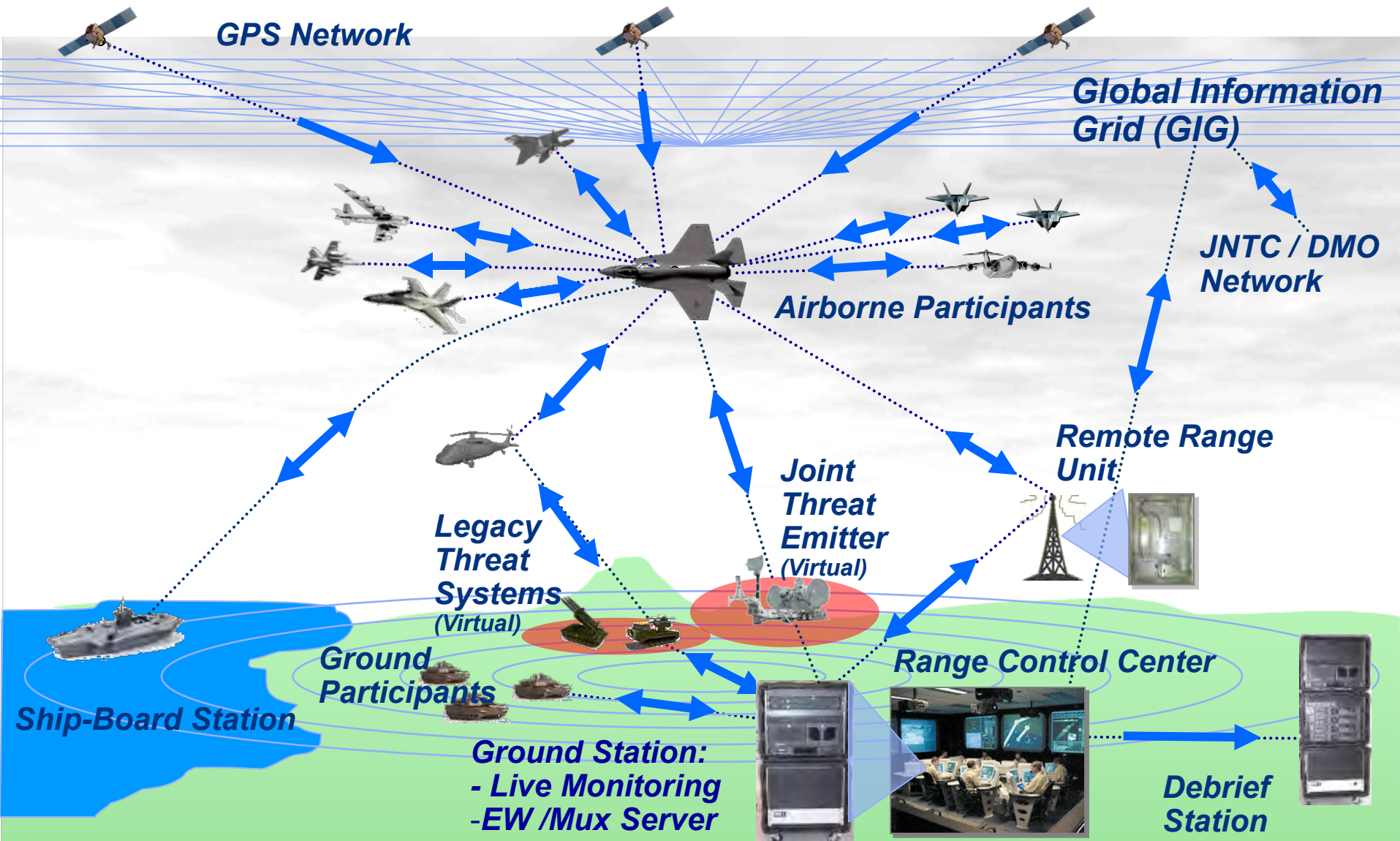


# Integrated Operations





# Integrated P5/LVC Operations





# ***P5CTS Fielding Status – Oct 2011***

- First Fielding at Luke AFB - Oct 2006

- Fielded Units:

<b>ACC</b>	
Eglin	COMP
Seymour-Johnson	COMP
Langley	COMP
Nellis/Ft Irwin (GF-W)	COMP
Mountain Home	COMP
Shaw	COMP
Barksdale	COMP
Hill	COMP
<b>AFRC</b>	
Homestead ARB	COMP
<b>ANG</b>	
Savannah CRTC	COMP
Gulfport CRTC	COMP
Alpena CRTC	COMP
Montana (Great Falls)	COMP
Volk Field CRTC	COMP
<b>AETC</b>	
Luke	COMP
Tyndall	COMP
<b>USAFE</b>	
RAF Lakenheath	COMP
Spangdahlem*	COMP
Aviano*	COMP

- On the Horizon:

2012 - Eielson	TBD
2013 - Holloman (F-16 move from Luke), Nellis (Red Flag-N)	
2014/15 - PACAF	

\* Awaiting European frequency approval



# P5CTS Air Force Fielding

**Fielded: 779 Pods**

**Contracted: 152 pods delivered in FY11**

**Programmed: 165 Baseline Pods purchase in FY12 (del FY13)**

**Planned: 368 Encrypted Pods (required FY 12, delivery TBD)**

**AF TOTAL: 1464 Pods**







# ***Transition Update - Retirement***

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- **Retired Pods**

- HAIS POD - Apr 06
- P4A (TACTS) – retired 2010
- P4AM – retired Jun 07
- P4AW – retired Aug 07
- P4BX – retired Dec 08
- P4G – retired Jun 09

- **Retiring Pods**

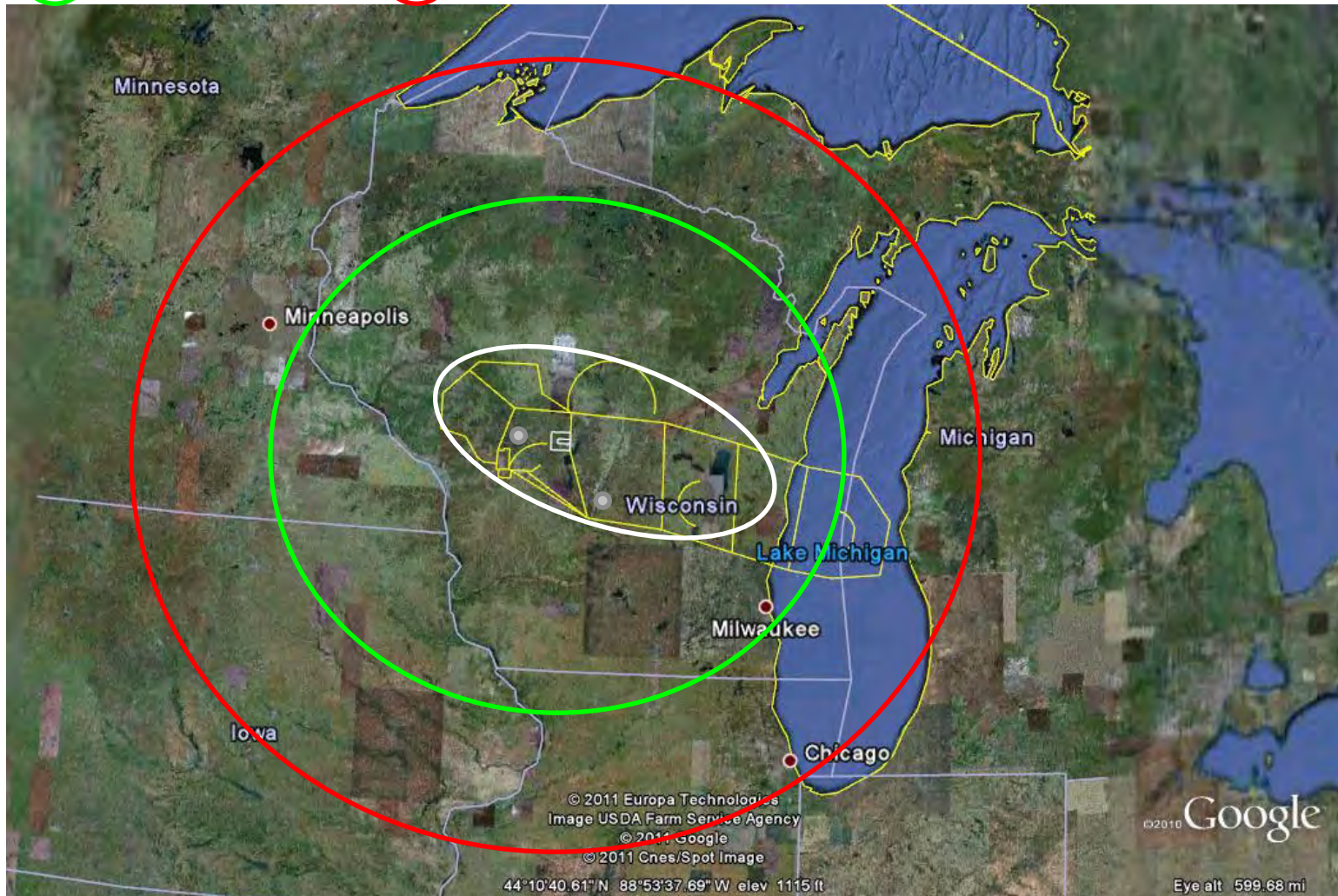
- URITS - NLT FY 12 (Projected to retire Jan 2012)
- P4B - NLT FY12 (Projected to retire Jan 2012)
- P4NS - NLT FY13/14
- P4BE – NLT FY 14/15

***Down to 8 AF pod system baselines***



# Ground Infrastructure Reduction

 = P5 no relay       = P5 with relay



**Old tethered range needed 18 TIS towers to cover the area in white. P5 covers the area in red with only 2.**

# 1974

## 1980

# 1987

# 1989

## 1990

## 1994

## 1996

## 1998

2000

2002

2004

2010

### Internal Stores

## MODSM Encryption

MODSM  
KGV-21  
Encrypted

KGV-23  
Encrypted  
AMODSM

**FACTS**   
-T36 Plate  
T36 Plate

**KITS** 

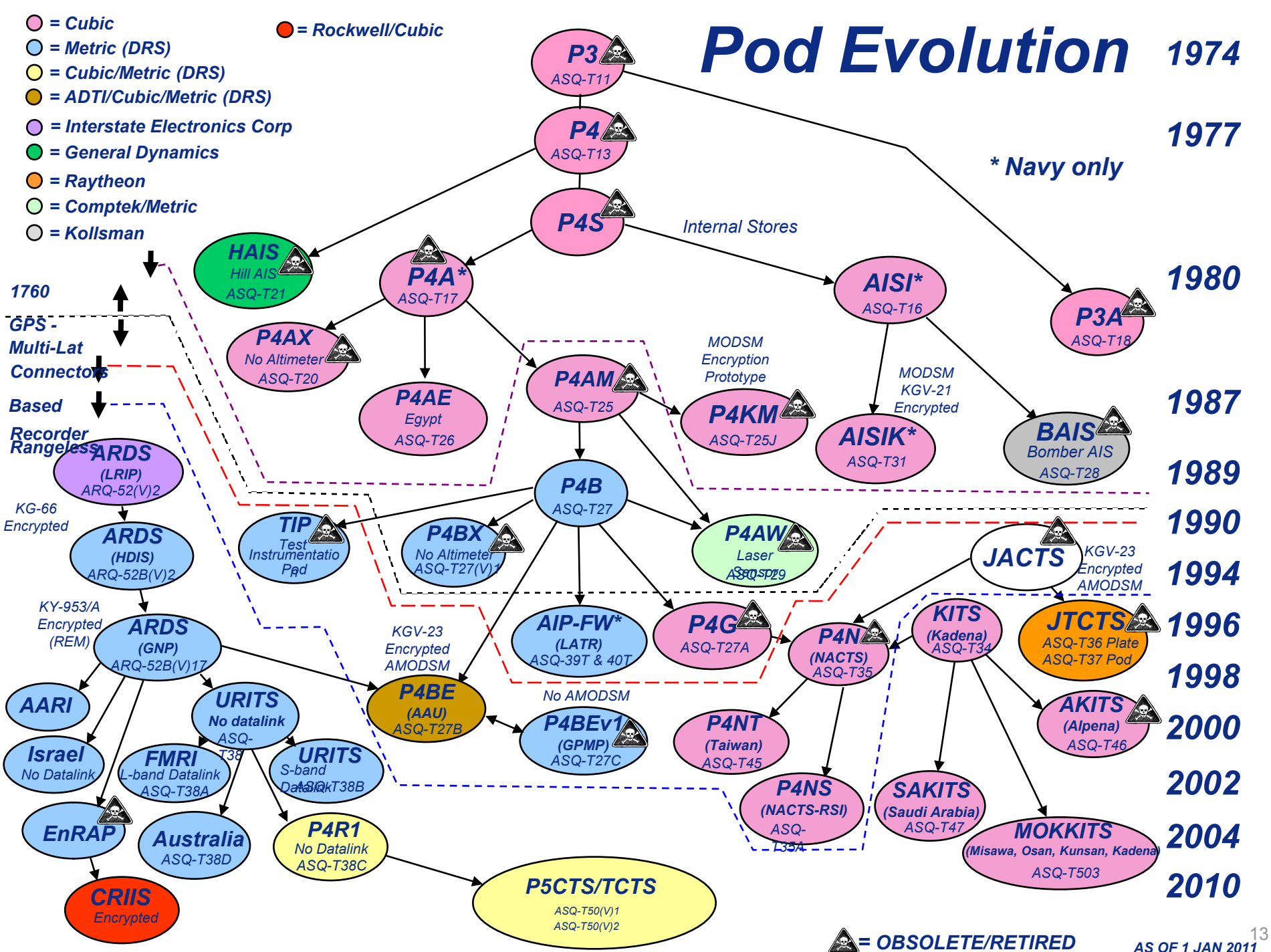
ASQ-T46

KITS

503

 = **OBSOLETE/RETIRED**

AS OF 1 JAN 2011<sup>13</sup>

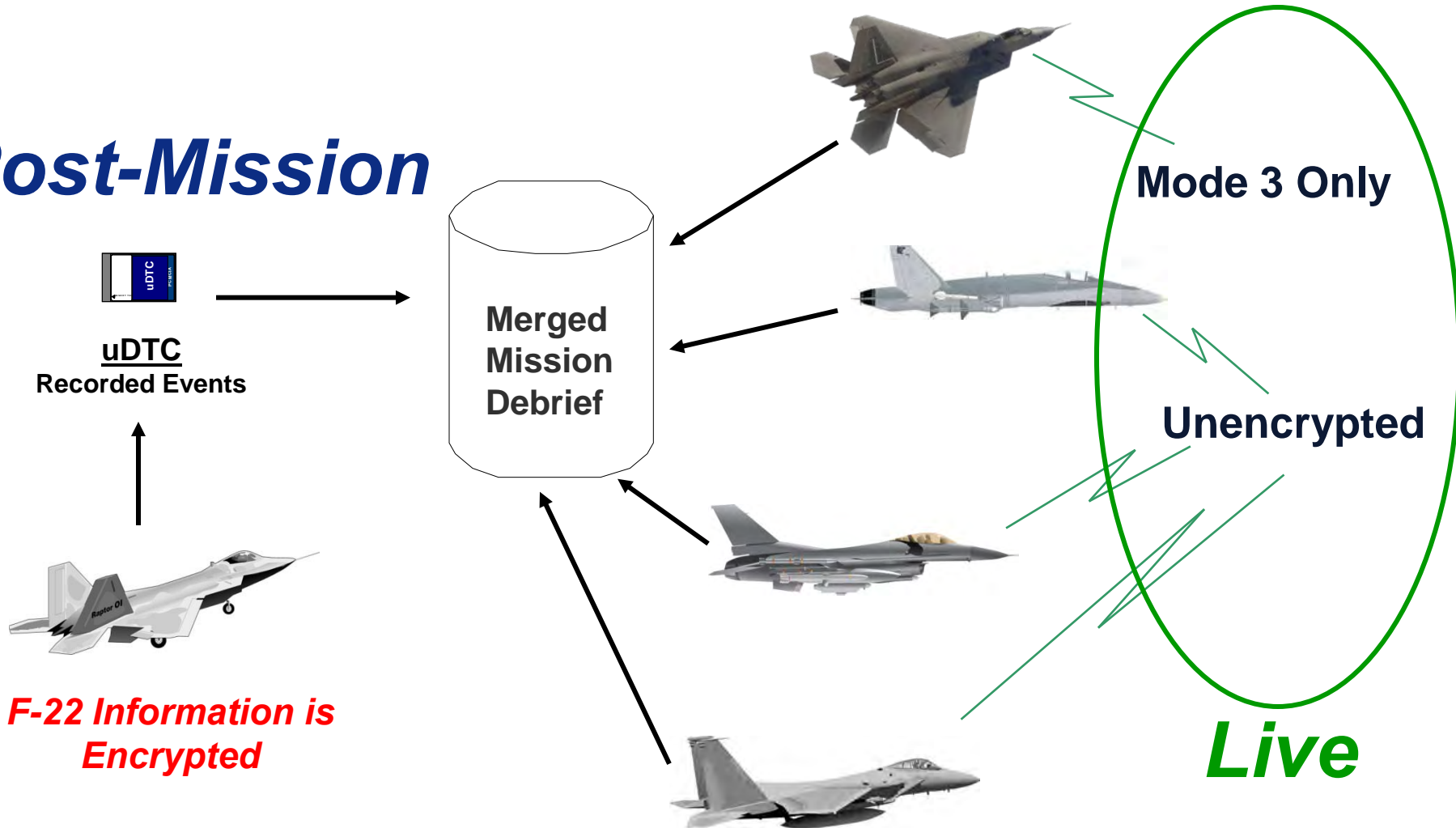




# F-22 ACTS Short-Term Solution

## Post-Mission Merge Debrief – Fall 08

### Post-Mission

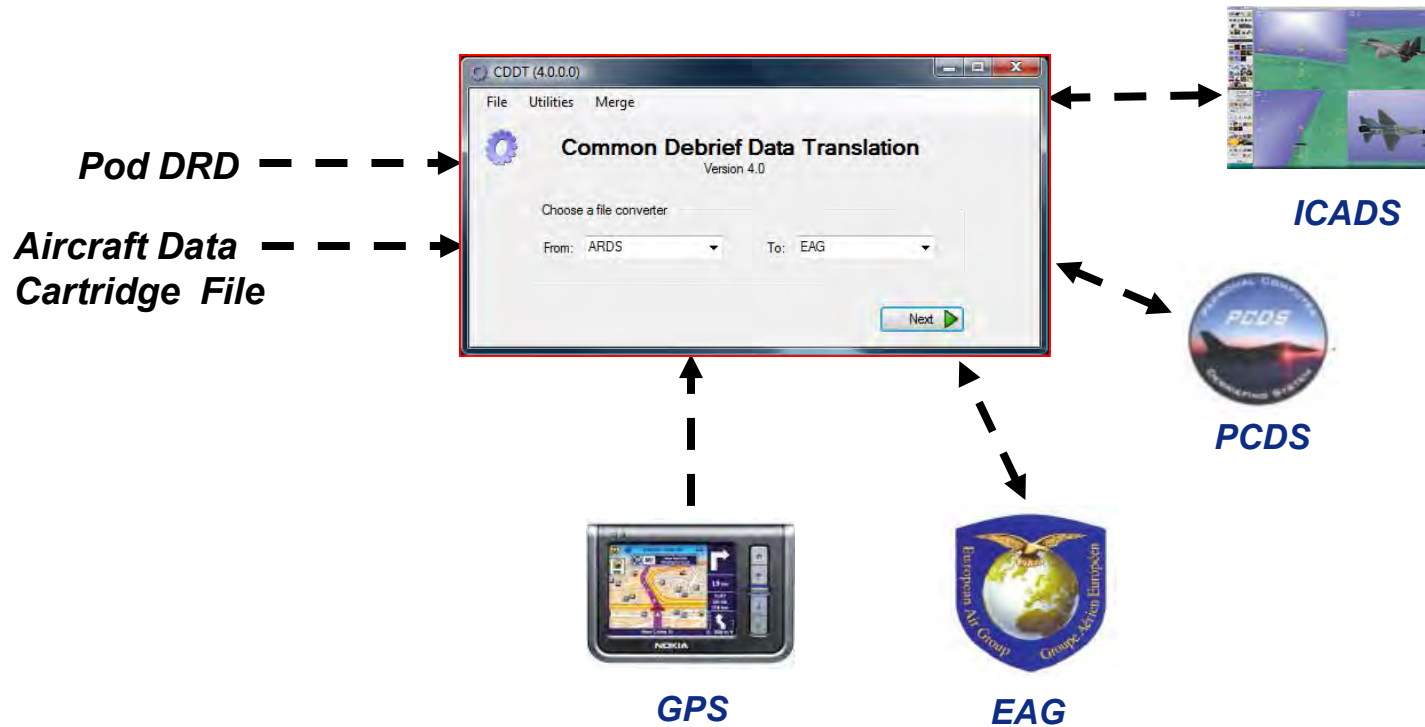


***F-22 long-term solution is an encrypted data link***





# CDDT System Overview



Plus one-way conversions for:

- ITAS
- JDS
- ARDS
- 4 GPS variants





***Questions ?***



# Marine Corps Operational Test & Evaluation Activity

Kenneth R Lardie

Expeditionary Test Division



49<sup>th</sup> TARGETS, UAVS & RANGE  
OPERATIONS SYMPOSIUM & EXHIBITION

26 October 2011





# Agenda

- **Mission and Vision**
- **Organization**
- **Resources**
- **Programs**
- **Working Relationships**
- **Test and Evaluation Process**
- **Operational Testing Requirements and Objectives**
- **Budget Impacts on Test and Training**
- **Questions**





# Mission & Vision



## Mission

**MCOTEA provides operational testing and evaluation for the Marine Corps and conducts additional testing and evaluation as required to support the Marine Corps mission to man, train, equip, and sustain a force in readiness.**

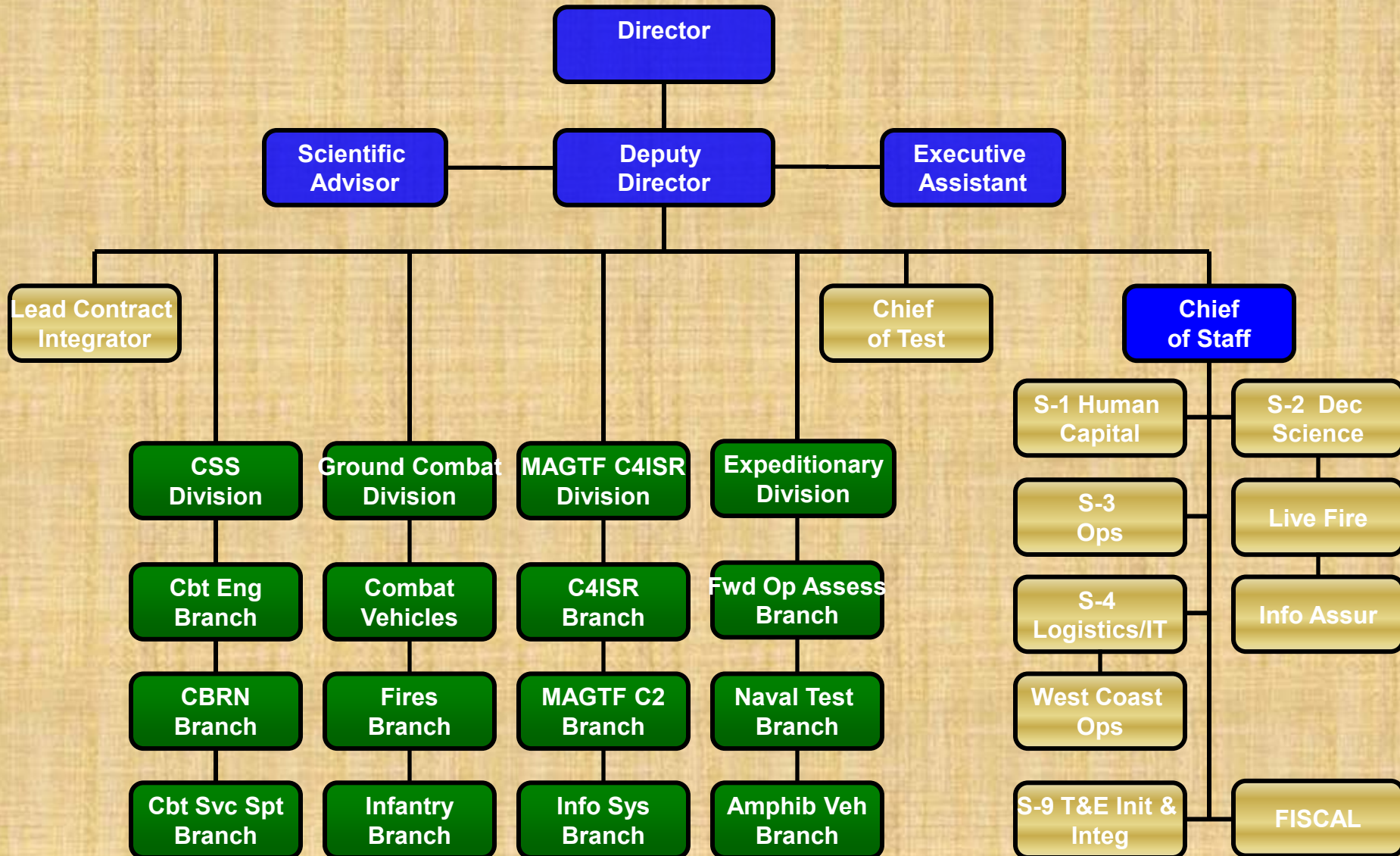
## Vision

- MCOTEA will be the Marine Corps leader in all aspects of realistic operational test and evaluation of material system capabilities throughout a material system's life cycle. Our highly trained, professional workforce will be a voice for the Operating Force Marine, enabling informed decision-making, and ensuring always that our test reports accurately and objectively describe what we know and don't know about the Operational Effectiveness and Suitability of the materiel solution we evaluate.**
- MCOTEA will be a source for objectivity in the Marine Corps and, where appropriate, DoD's acquisition process. Our expertise, professionalism, and integrity will make us a sought-after partner within the DoD acquisition community.**





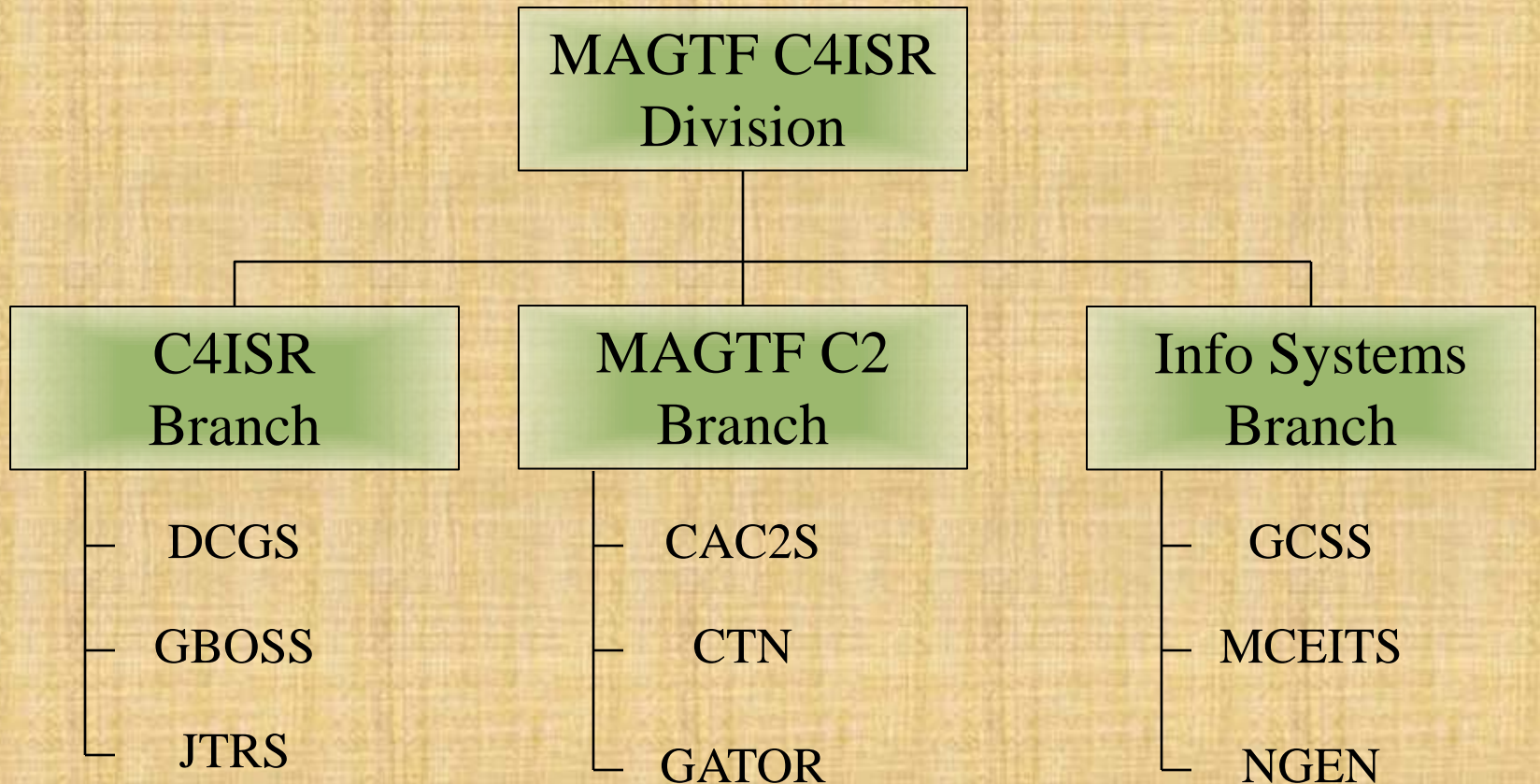
# MCOTEA Organization





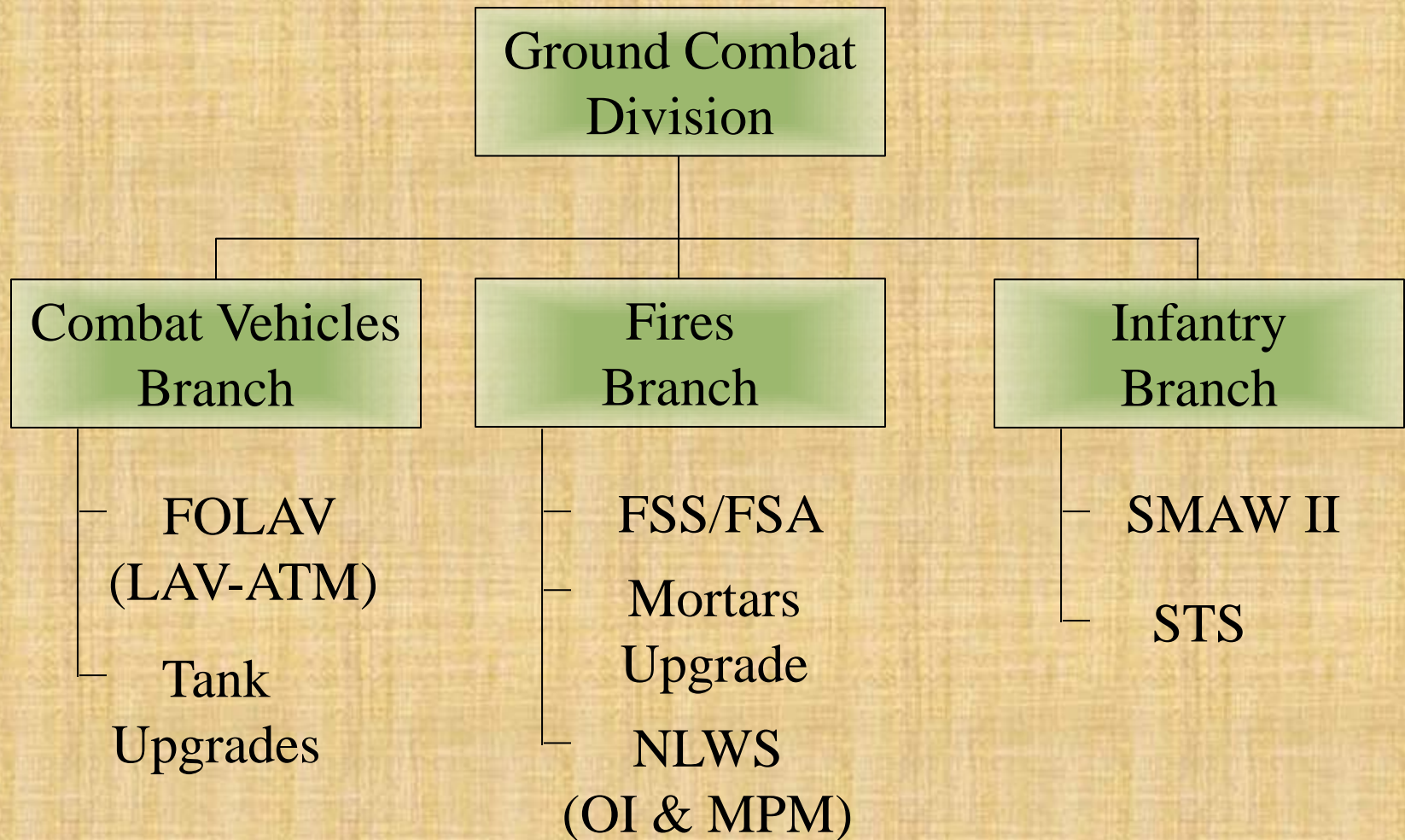


# MAGTF C4ISR Division





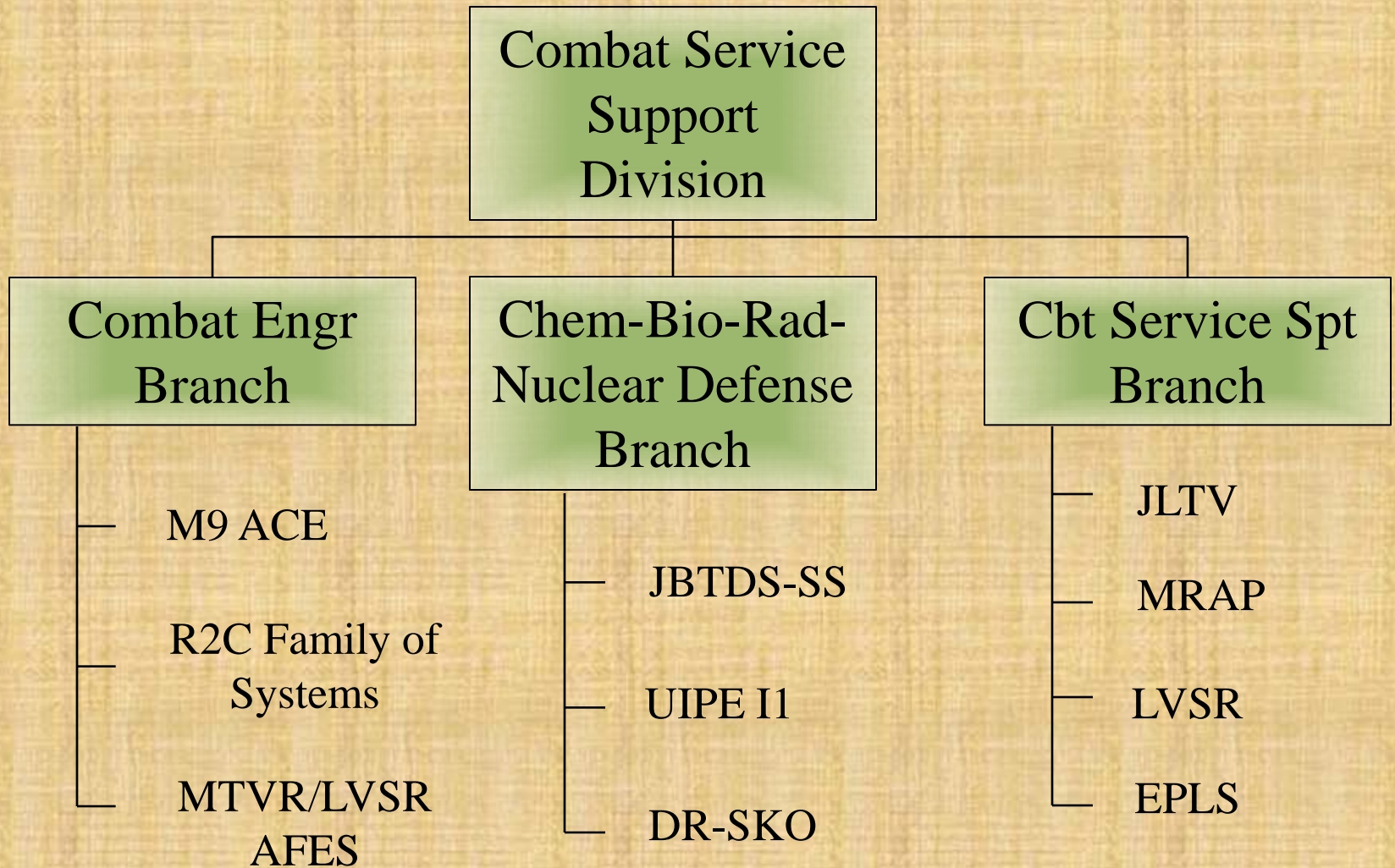
# Ground Combat Division





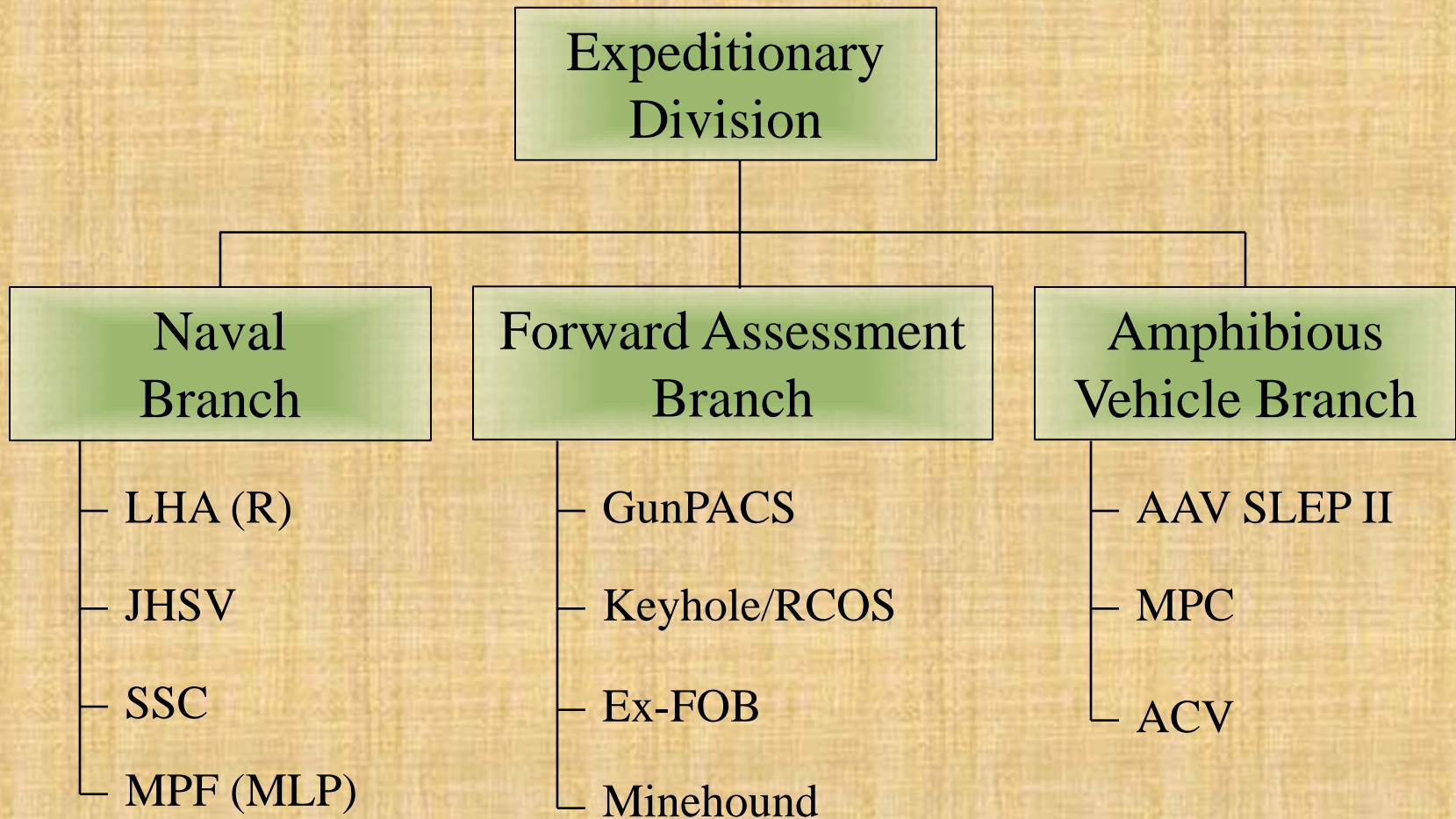


# CSS Division





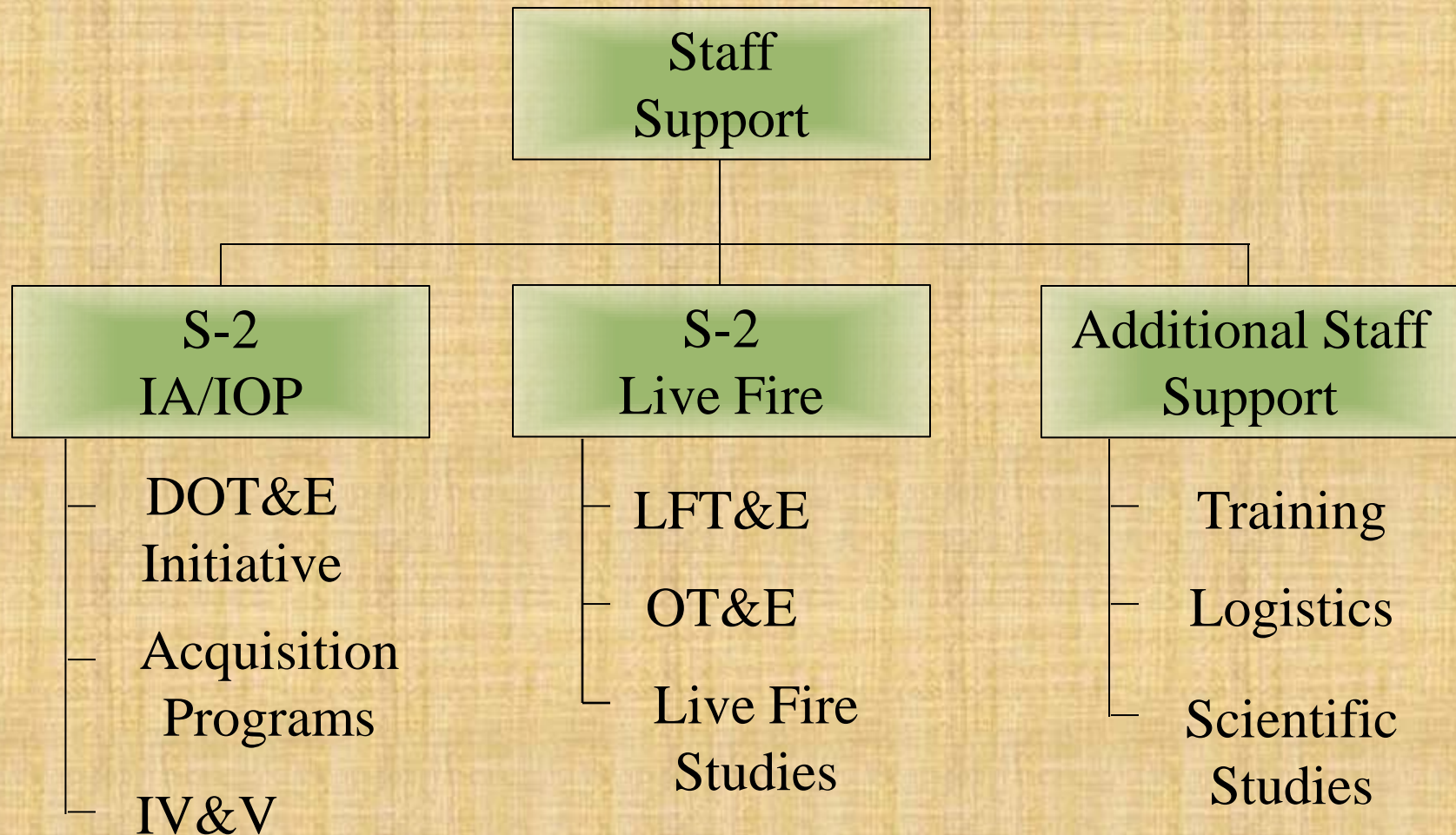
# Expeditionary Division







# Activity Level Support







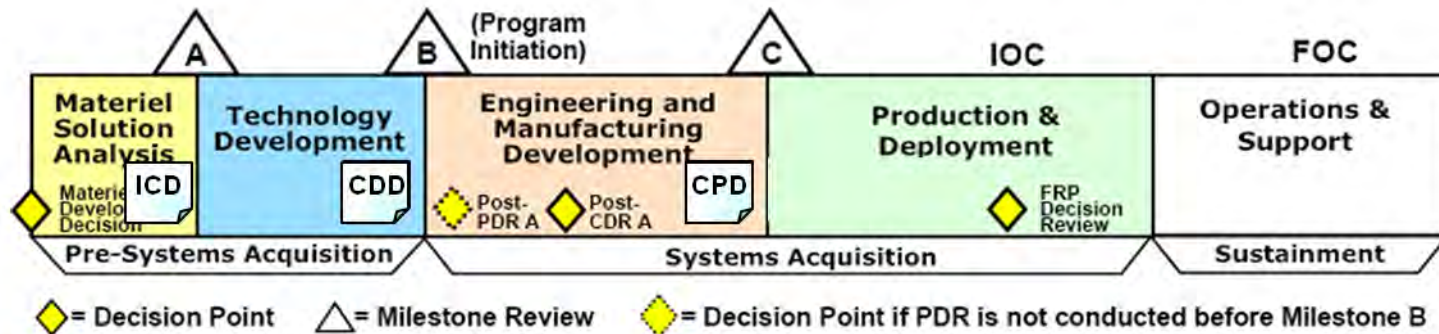
# RESOURCES

- **Facilities / Equipment**
  - **Headquarters: Quantico, VA**
    - **Test Support Facility at Camp Wilson, 29 Palms, CA**
    - **Test Support Facility at Del Mar (21 Area), Camp Pendleton, CA.**
- **Test Instrumentation**
  - **Portable Data Collection Suites**
  - **Data Instrumentation Vehicle**
  - **Web-based, data repository**
- **Personnel**
  - **Mix of active duty Marines and government civilians**
    - **28 Active duty Marines**
    - **42 Government civilians**





# Distribution of T&E Efforts by Acquisition Phase



<ul style="list-style-type: none"> <li>Technology Development Strategy (TDS)</li> <li>Test Evaluation Strategy (TES)</li> <li>ID emerging T&amp;E capability requirements</li> <li>ID T&amp;E resources</li> <li>Develop T&amp;E requirements in RFP</li> <li>Reporting</li> </ul>	<ul style="list-style-type: none"> <li>Systems Evaluation Plan (SEP)</li> <li>Test and Evaluation Master Plan (TEMP)</li> <li>Execute T&amp;E Program</li> <li>CDD requirements for testability and evaluation</li> <li>TRL Evaluation</li> <li>Reporting</li> </ul>	<ul style="list-style-type: none"> <li>SEP</li> <li>TEMP</li> <li>Execute T&amp;E Program</li> <li>Support PDR/CDR</li> <li>CPD requirements for testability and evaluation</li> <li>TRL Evaluation</li> <li>CT / DT</li> <li>Discovery and correction</li> <li>OA</li> <li>Reporting</li> </ul>	<ul style="list-style-type: none"> <li>SEP</li> <li>TEMP</li> <li>Execute T&amp;E Program</li> <li>Characterize system capabilities and limitations</li> <li>T&amp;E results to MDA</li> <li>AOTR / OTRR</li> <li>Support training for IOT&amp;E</li> <li>IOT&amp;E / FOT&amp;E</li> <li>Reporting</li> </ul>	<ul style="list-style-type: none"> <li>Follow-on DT and OT</li> <li>Verification of corrections for deficiencies</li> <li>Develop T&amp;E programs to support upgrades, modifications, increments</li> <li>Reporting</li> </ul>
<b>4%</b>	<b>12%</b>	<b>38%</b>	<b>40%</b>	<b>6%</b>

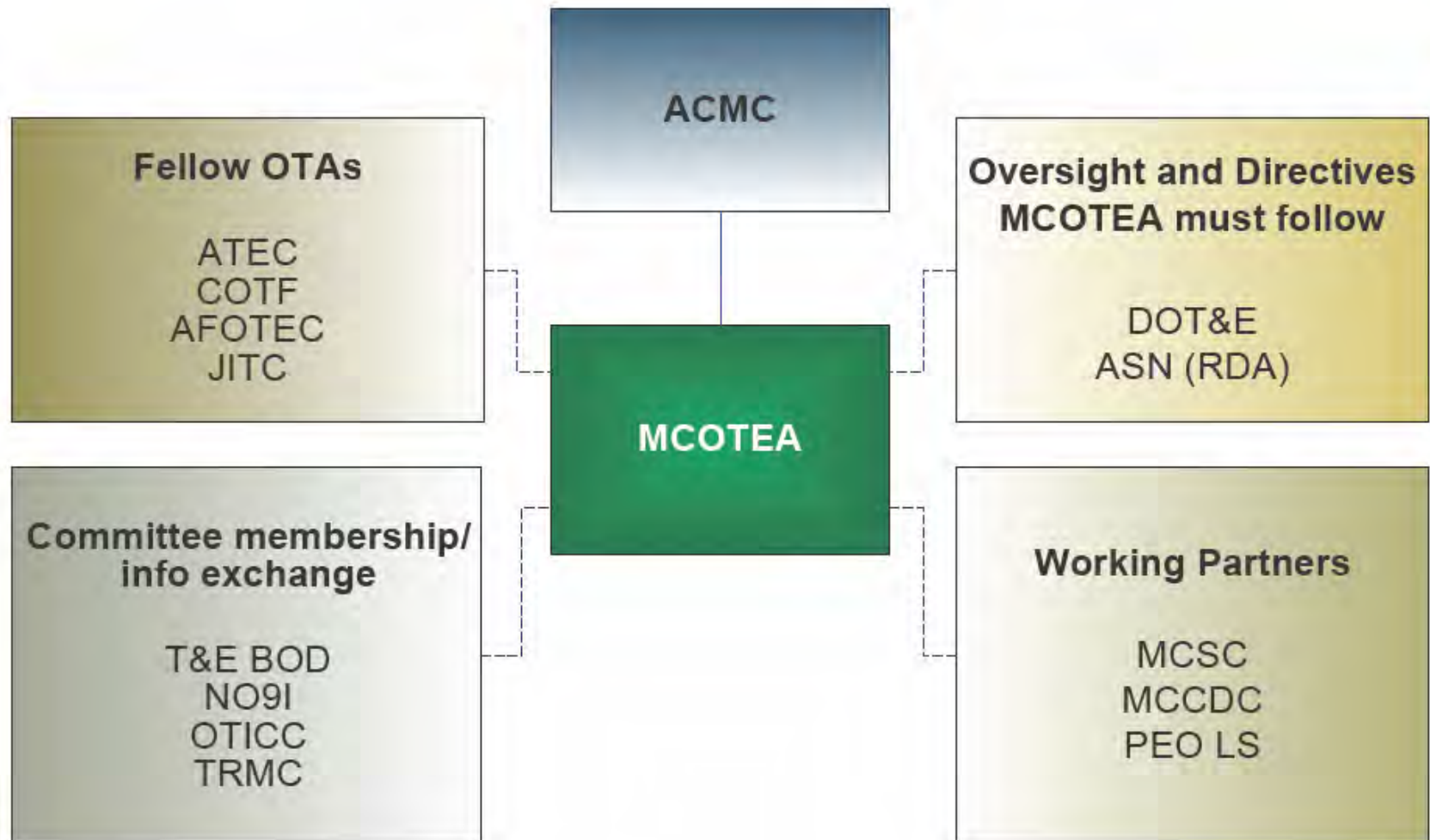
## Programs Supported:

ACAT 1 thru ACAT IV, AAP's, UNS, USON, and Forward Operational Support  
 Currently supporting 125 programs.





# Organizational Relationships







# Test & Evaluation Processes

## MCOTEA's 6-step Operational Test and Evaluation Process

Plan

Test

Report

### 1 System Evaluation Plan

- Program Initiation
- SEP Development

### 2 Test Concept, Test and Evaluation Master Plan Input, and Failure Definition/Scoring Criteria Charter Development

### 3 Test Planning

- Operational Test Plan and Logistics

### 4 Operational Test Execution

- New Equipment Training
- Pilot Test
- Record Test
- Posttest Activities
- Test Data Report Development

### 5 Test Data Report

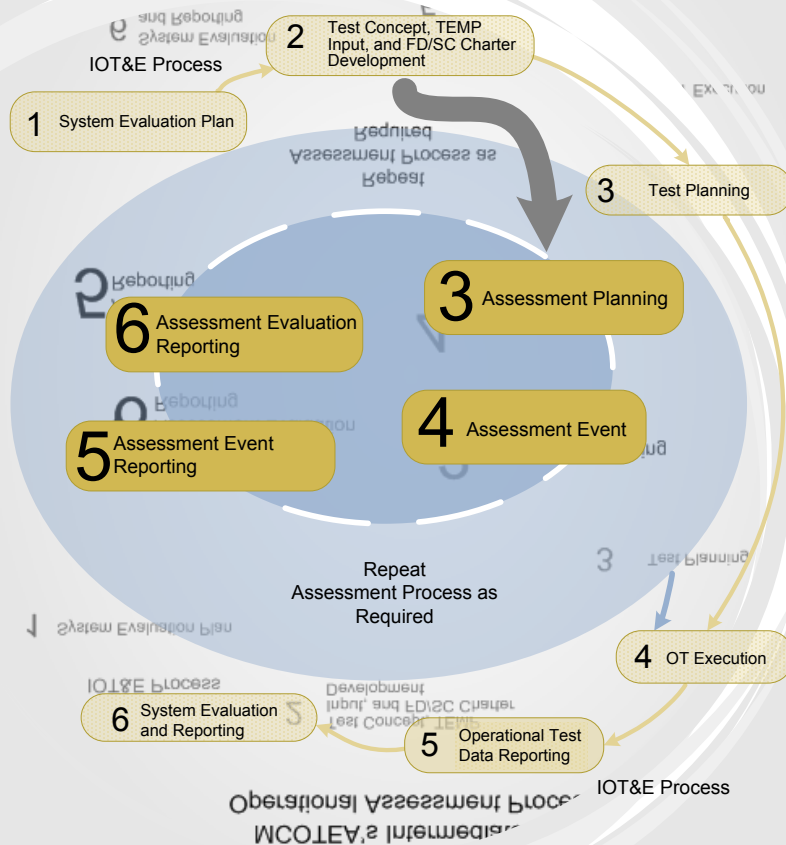
- Test Deviations
- Data (unanalyzed)

### 6 System Evaluation and Reporting

- Final evaluation
- Operational Test Agency Evaluation Report (OER)
- or Operational Assessment Report (OAR)

Continuous Evaluation Occurs during *Integrated Testing*

## MCOTEA's Intermediate and Operational Assessment Process





# **Operational Testing Requirements and Objectives**

- **Top-level requirements for adequate operational testing:**
  - employ a production-representative system in realistic operating conditions with typical Marine operators and maintainers
  - collect data that accurately describes the test conditions and system performance results
  - analyze the data independently and without bias for use in system evaluation
- **Top-level requirements for objective system evaluation:**
  - collect and evaluate information from a variety of developmental and operational test events
  - determine if thresholds in the approved capabilities documentation and Critical Operational Issues have been satisfied
  - determine the system's Operational Effectiveness (OE), Operational Suitability (OS), and Operational Survivability (OSur)
  - assess system effects on combat operations
  - provide any additional information on the system's operational capabilities





# Budget Impacts on Test and Training

- ❑ **Continue coordination with Program Managers (SuT & TRNG) and Training & Education Command (TECOM) in development of test resource assets that supports future training with the new SuT.**
- **Realistic Targets**
  - ❖ *REMTT – Full Scale 3D Realistic Electro-Magnetic Threat Tarfet*
  - ❖ *TVST- Full Scale 2.5D Threat Vehicle Surrogate Target*
  - ❖ *RLCT- Full Scale 2.5 Realistic Low Cost Target*
- **Instrumentation**
  - ❖ *POESIS – Portable Oceanographic Environmental Sensor Instrumentation System: Surf Arrays; Wave Buoys, Digital Weather Stations, Low Light Video – RF / integrated to single command suite.*
  - ❖ *FOFTI – Force-On-Force Test Instrumentation: Laser engagement system for armored vehicle systems and supports gunner/crew training*





- **Questions?**

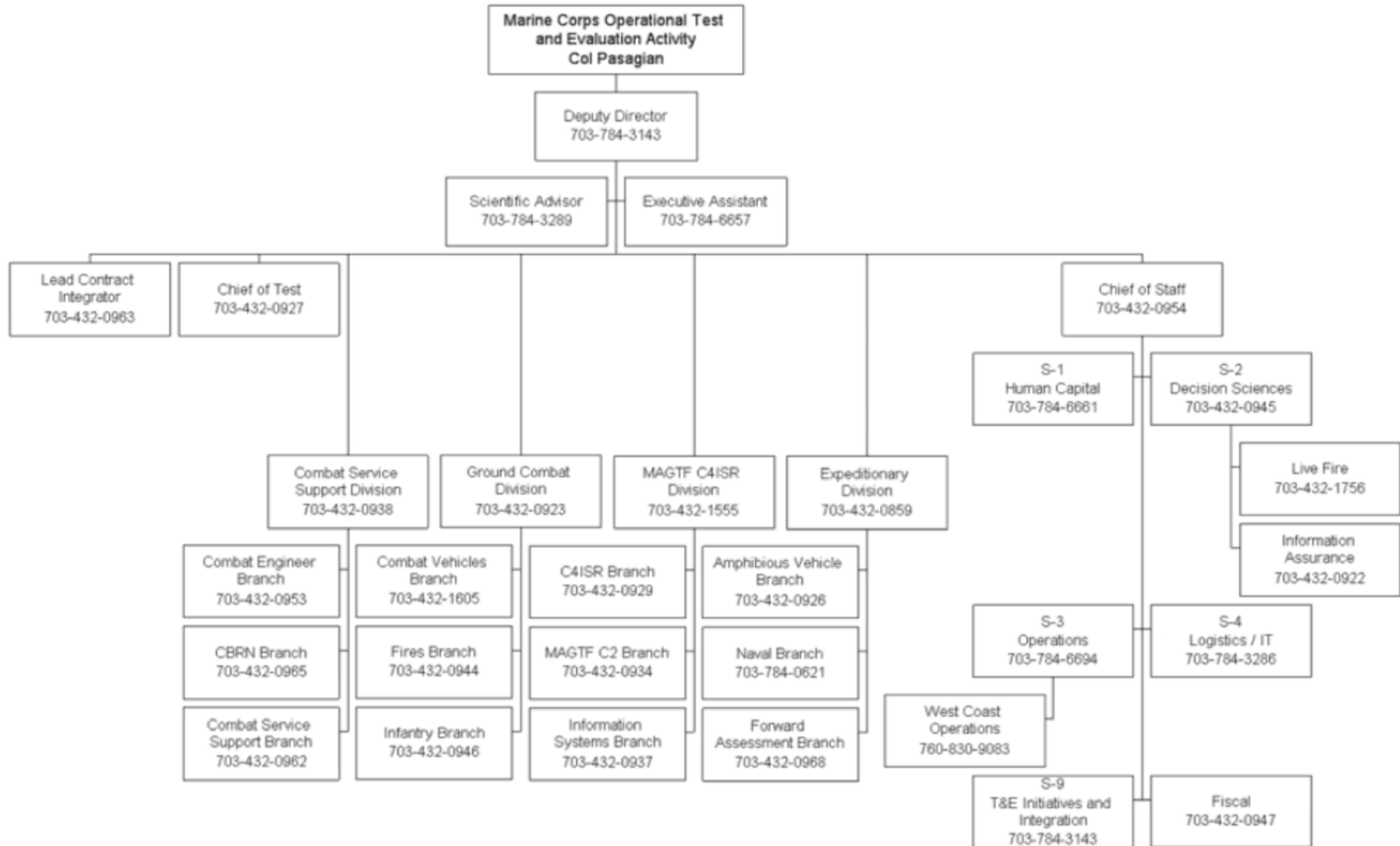
**Semper Fidelis!**







# MCOTEA Organization



# Hugh Harris Scholarship



## ◆ My Purpose

- ◆ Provide annual update to the membership
- ◆ Review/Inform membership on application procedures
- ◆ Solicit your continued support by
  - ◆ Identifying qualified applicants
  - ◆ Providing continued financial support

# Purpose of Scholarship



- ◆ Memorialize Hugh Harris
- ◆ Provide Financial Assistance to Eligible Students
- ◆ Encourage Interest in:  
Science/Engineering/Technology/Mathematics  
(STEM)

# Educational Crisis



- ◆ In 30 Years US Public Education Dropped from No. 1 in the World to No. 29
- ◆ All-STEM Degrees (% of total awarded)
  - ◆ S. Korea: 37.8%
  - ◆ Mexico: 28.1%
  - ◆ US: 17.6% (Engineering 5%)



# Scholarship Status



- ◆ Established in 1991: Goal \$50K, to be self sustaining
  - ◆ Funds Administered by NDIA HQ.
- ◆ First Scholarship Awarded in 1992
  - ◆ One \$1000 Award in '92
  - ◆ Awarded \$68K to date
- ◆ This year's winners
  - ◆ Savannah Lloyd: University of Florida
  - ◆ Ian Villaluz: University of Alabama
  - ◆ Robert Witt : University of Florida
  - ◆ Keith Nygaard: Colorado School of Mines
  - ◆ Tyler Thorneberry: University of Florida
  - ◆ Joseph Morris: Clemson University
  - ◆ Carroll Cameron: Florida State University

# Scholarship Schedule



- ◆ 20 January: Members identify applicants
- ◆ 1 February: Mail info packets to applicants
- ◆ 15 March: Applications to Scholarship Committee
- ◆ 1 April: Scholarship Committee ranks applicants
- ◆ 10 April: Executive Committee determines number/amount of scholarships
- ◆ Early August: NDIA issues scholarship grants

# Eligibility



- ◆ Be a US Citizen
- ◆ High school senior or graduate
- ◆ Applied to/enrolled in accredited 4 year college
- ◆ Pursuing STEM career
  - ◆ Science
  - ◆ Technical: Physics, Chemistry
  - ◆ Engineering: Aerospace, Chemical, Civil, Computer, Electrical, Industrial, Mechanical, Software
  - ◆ Mathematics

# Eligibility (continued)



- ◆ Sponsored by Targets/Ranges/UAV Division member (individual or corporate)
- ◆ Sponsored by Gulf Coast Chapter
- ◆ Recipients of full scholarships (military academy, ROTC, etc.) are ineligible
- ◆ Enrollments in 2-year community colleges are ineligible
- ◆ Complete by-laws are available upon request



# Your Responsibilities



- ◆ Identify Potential Applicants
- ◆ Notify Scholarship Committee

Cort Proctor

1542 Glenlake Circle

Niceville FL 32578

email: [cortp@aol.com](mailto:cortp@aol.com)

- ◆ Ensure continued tax deductible donations  
(corporate/individual)

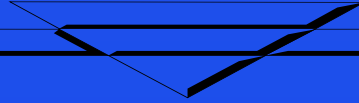
# 2011 Contributors



NDIA's Gulf Coast Chapter: \$3000

THANKS

# Questions



?

# K-MAX Cargo Unmanned Aerial System

October 2011

Bud Sauvageau

Kaman Aerospace  
**KAMAN**

**LOCKHEED MARTIN**



# Agenda



- **K-MAX Capabilities**
- **Resupply Need**
- **K-MAX History → Manned / Unmanned Variant**
- **K-MAX Demos**
- **Cargo UAS Program**
- **Emerging DoD Programs**
- **Questions**

# K-MAX: Purpose Built for the Mission



- **K-MAX is the only helicopter designed, built, and tested, for the repetitive lift industry. Made for the logging industry**
- **K-MAX manned version is FAA Certified!**
- **Aircraft has proven itself with over 260K hrs on the K-MAX fleet**
- **Intermeshing rotors eliminate tail rotor and simplify maintenance**
- **K-MAX cost / maintenance / fuel burn < 1/2 manned cargo RW**
  - **\$1,100 / hr – Direct Operating Cost**
  - **2 Maintenance Man Hours per Flight Hour (MMH/FH)**
  - **85 gal / hr – Fuel Burn Rate**

**Proven Performance & Affordable Solution**

# K-MAX Aircraft Capabilities



<b><u>Speed</u></b>	with load:	80 kt
	without load:	100 kt
<b><u>Range</u></b>	internal fuel:	267 nm
<b><u>Endurance</u></b>	internal fuel:	2 hr 41 min
	ext. aux tank:	12+ hr
<b><u>Max Payload</u></b>		6,000 lb
<b><u>Weight</u></b>	Max Gross:	12,000 lb
	Max Take-Off:	7,000 lb
	Empty:	5,145 lb
<b><u>Lift</u></b>	at sea-level:	6,000 lb
(ISA +15°C)	at 15,000 ft:	4,313 lb
<b><u>Multiple Delivery</u></b>		1 to 4

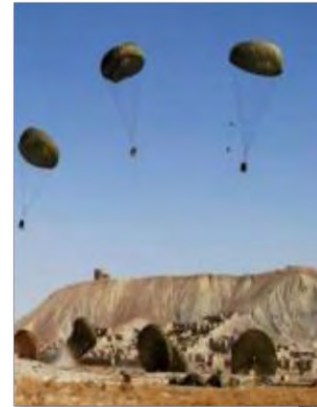


## K-MAX Maintains Performance in High/Hot Environment

# Resupply Need



- **Mission Critical / Time Sensitive (MC/TS) resupply to any unit**
- **Routine resupply to a single company-size unit or several smaller units in a 24 hr period**
- **Difficulty transporting heavy loads over unimproved roads, inhospitable terrain and IED susceptibility on supply convoys**
- **Limited numbers of utility/cargo helicopters are conducting logistical resupply missions and are not able to focus on combat operational support missions**
- **Threat to manned aircraft and personnel**
- **Insufficient rotary wing resupply capabilities caused by extreme heat and high altitudes**
- **Inability to conduct precision aerial delivery and retrograde**



**Unmanned K-MAX is the Solution!**

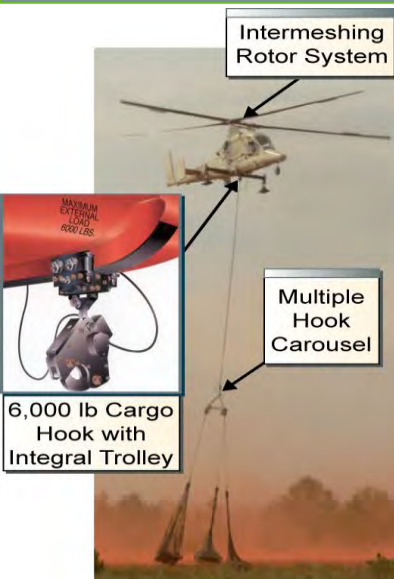


# K-MAX History



'93

## K-MAX Development



## K-MAX Production

*Designed, Built, Certified for Repetitive Lift*  
*Applications: Logging, Construction, Fire Fighting, Mining Surveys*

FAA certification '94  
 >244,000 flight hrs.

*Unique Intermeshing Rotor System*  
 6000 lb lift capability  
 One to one lift ratio  
 Low noise signature  
 Low Maintenance Cost

'99

## Early UAS

*High Power RF LOS*  
 -Range ~50 nmi  
 -Close proximity control

*Limited authority Control Station*

'03

## Successful Demos

*Ft. Eustis*  
*Eglin to Rucker*  
*Ft. Benning*  
*Endurance – Bloomfield CT (12+ hrs)*  
*Ft. Eustis*  
*Quantico*



'09

## Robustness

*Mission Planning*  
*Dynamic Retasking*  
*Contingency Mgmt*  
*GCS Simplified Interface*  
*Automated Load Delivery*  
*Level 5 Control*  
*Full Authority Autopilot Communications*  
 - Enhanced LOS  
 Datalink  
 - BLOS

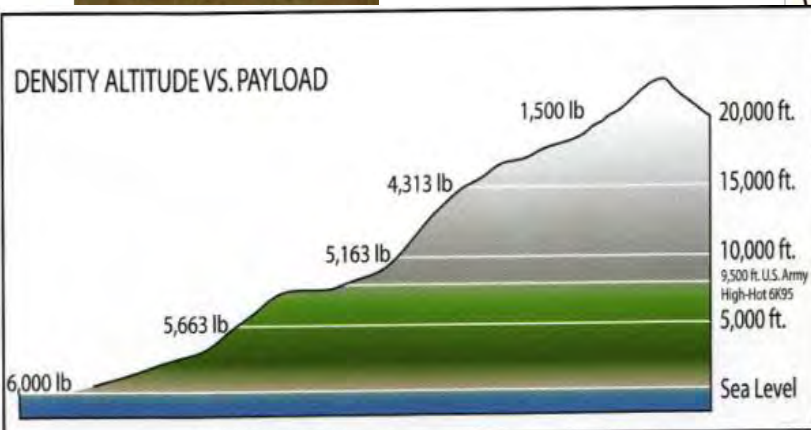
'10

## Contracts!

NAVAIR:  
 USMC  
 Immediate  
 Cargo Re-supply

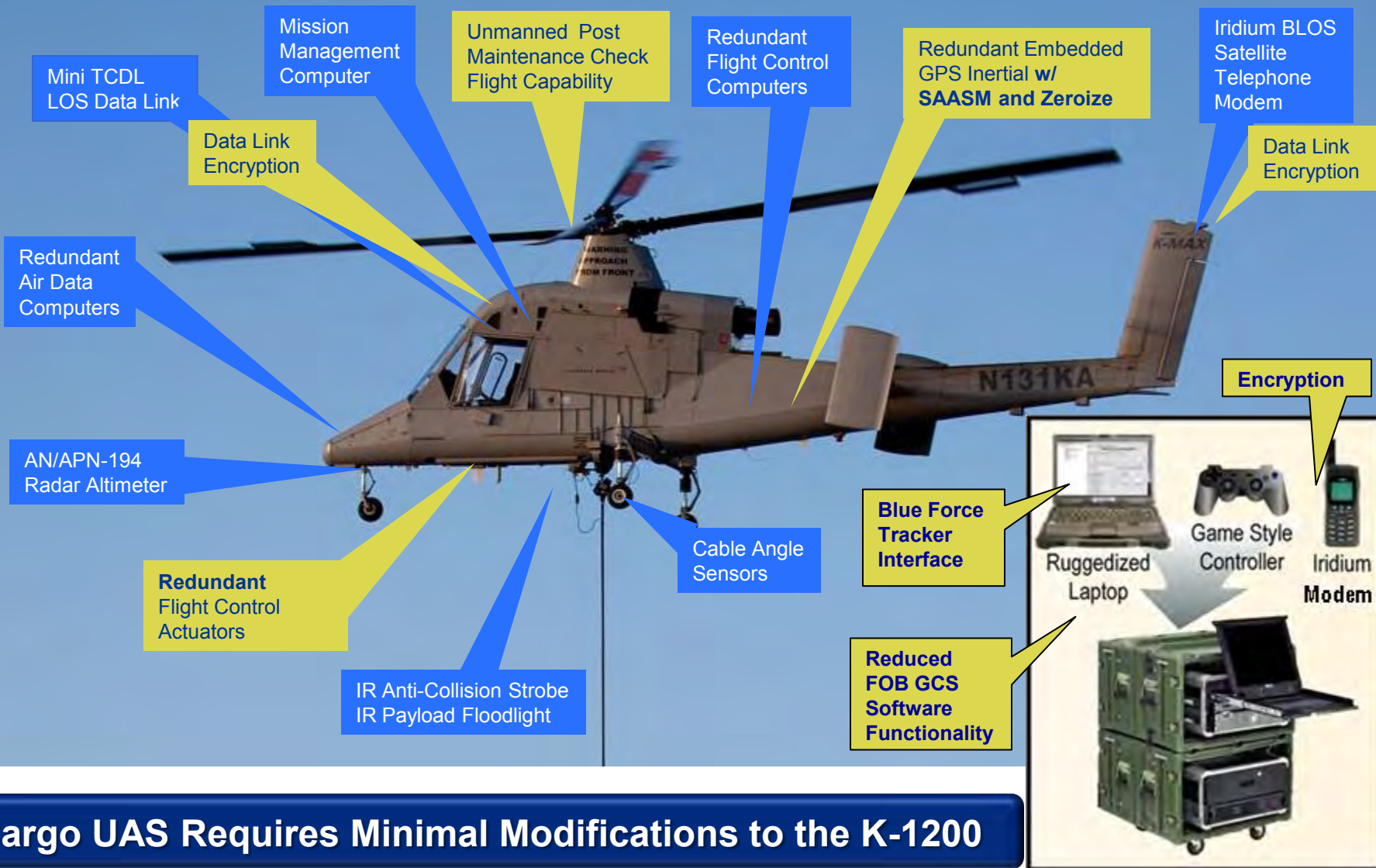
AATD: USA  
 JCTD

'11



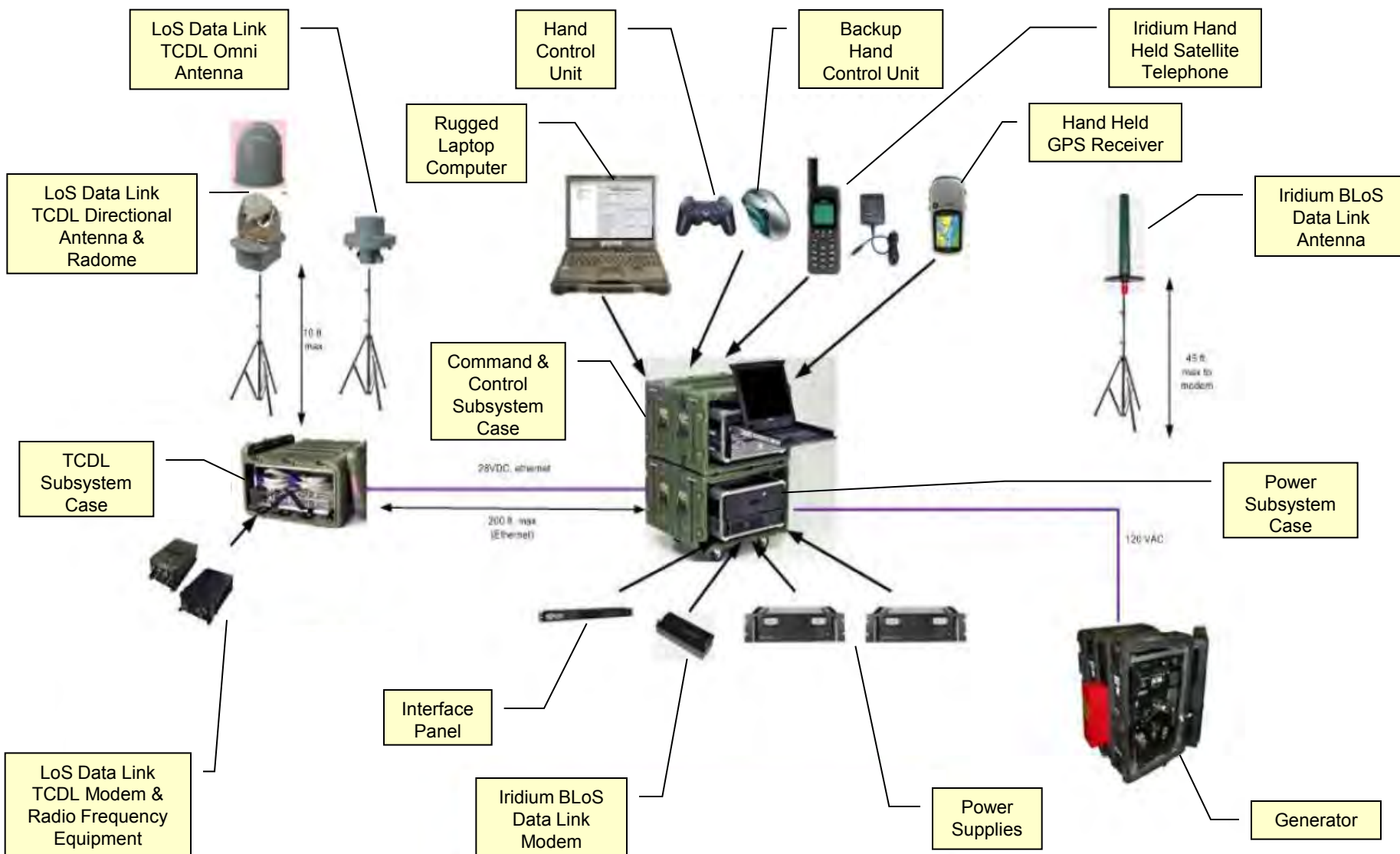
900+ UAS Flight Hours to Date

# Cargo UAS Program



**Cargo UAS Requires Minimal Modifications to the K-1200**

# Ground Control Station





# Concept of Operations



- NAVAIR RFP (N0019-10-R-0020) – 22 Sep 2010





# Emerging DoD Programs



- **NAVAIR RFP (23 Sep 2010)**
  - **USMC Immediate Cargo Re-supply - Awarded in Sep 2011**
- **Joint Capability Technology Demonstration (JCTD)**
  - **AATD (Aviation Applied Technology Directorate) ATUAS (Autonomous Technologies for UAS)**
- **Proposed Naval Research**
  - **ONR (Office of Naval Research) AACUS (Autonomous Aerial Cargo/Utility System)**

# Summary



- **Unmanned Cargo Resupply emerging mission**
- **Requirements are established to address the need**
- **K-MAX proven platform for repetitive lift**
- **Lockheed Martin and Kaman Aerospace making unmanned cargo capability forward**
- **Near term deployment will demonstrate utility in theater**

**K-MAX is the right aircraft for unmanned Logistics Resupply !**





**WBB CONSULTING**  
*Solutions and Support for a Changing World*

# NDIA Symposium Targets, UAVs & Range Operations

## Range Encroachment Defense



October 26, 2011

Steve Shegrud  
Whitney, Bradley & Brown  
703-448-6081 ext. 263  
[sshegrud@wbbinc.com](mailto:sshegrud@wbbinc.com)



# Current Encroachment Issue

## How TARAT Is Helping DoD / DoN



## Notional Wind Turbine Placement



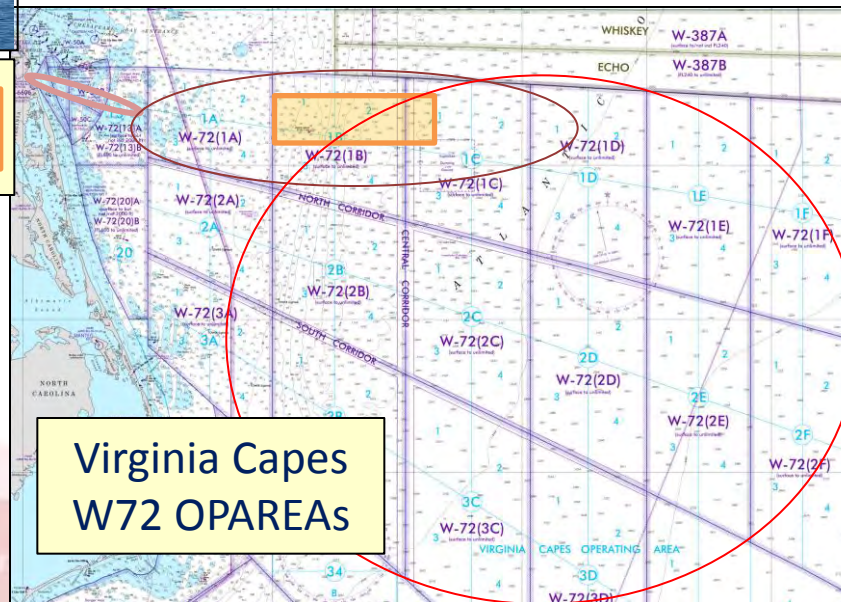
## Encroachment Issue

- VA Task Force wants wind farms in close to Norfolk power grid
- USN wants wind farms further out to lessen impact on training



## OPAREA Usage Example: Ship Missile Exercise

- Drone Launch/Transit
- Drone Tracking Area
- Missile Hazard Pattern



## Virginia Capes W72 OPAREAs

***What is the full 'impact' on DoD / Services for test and training events?***  
*DoD / DoN need a better range encroachment defense to show the full impact to T&E and Fleet Training if certain OPAREA grids are lost or availability is reduced...*

# Coastal and Marine Spatial Planning (CMSP)



THE WHITE HOUSE COUNCIL ON ENVIRONMENTAL QUALITY

*Final Recommendations  
Of The  
Interagency Ocean Policy  
Task Force  
July 19, 2010*



- CMSP above all is **ecosystem**-based
- National policy driven; **regional** focus
- NOAA-White House Council on Environmental Quality **culture**
- Navy strategy must ensure strong and convincing analytic representation of Navy's national security equities (e.g., operating sonar in littorals, etc.) and persistently challenge any measures which may restrict valid T&E or Fleet Training, sensor employment or other operational requirements
- Navy-Marine equities **need stronger metrics-based analysis** against this new scientifically-based culture



# Data Needed to Defend Range From Encroachment

## Identify Hazardous Activity in OPAREAs

- Ship events
- Submarine events
- Low flying aircraft events
- Aerial targets (subsonic, supersonic)
- Seaborne targets
- UW targets
- HM sled-dragging events
- Ordnance (live or inert) expended, dropped, launched
  - Ships & Submarines
  - Aircraft
  - USCG
  - NASA
  - USMC Air
  - USAF
  - USA
  - Other / DOD

**Link event data with hazardous activity – Display by OPAREA Grid**

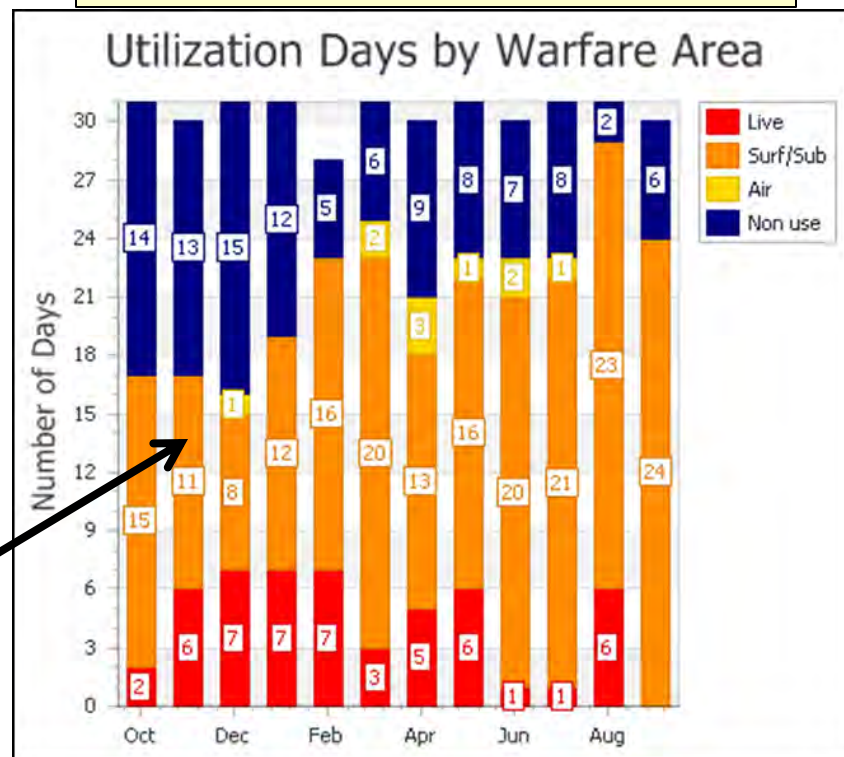
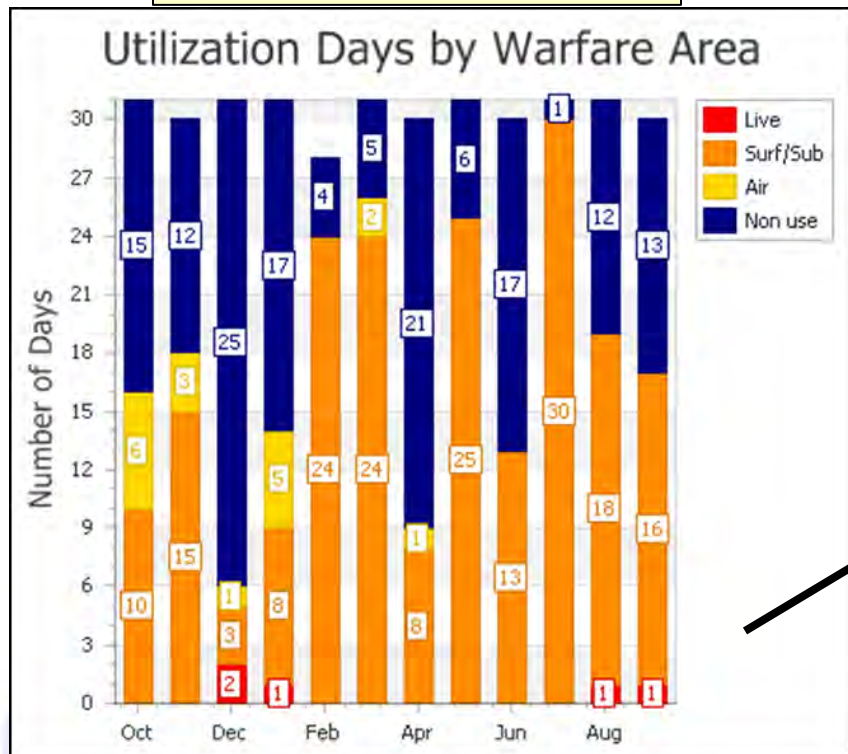


# W122 (5) Utilization Side-by-Side Comparison

Dashboard Report after partial data integration effort (Sep11)

TARAT with TRIMS & SHARP  
Data - FY09 Data

TARAT with TRIMS, SHARP, NAVSKED, TRMS  
& TORIS Data – FY10 Data



**Usage curve increases from FY09 to FY10 with additional data sources**

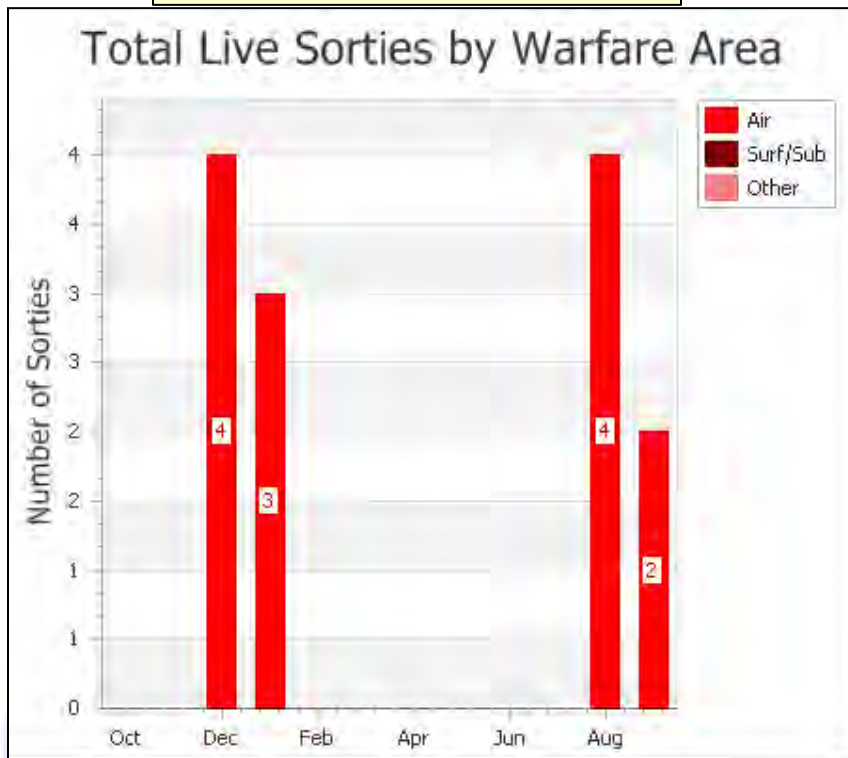
- Improvements over initial dashboard reports (less 'Blue' or 'No Use' days)
- 'Ship Events' will significantly increase with identified additional data



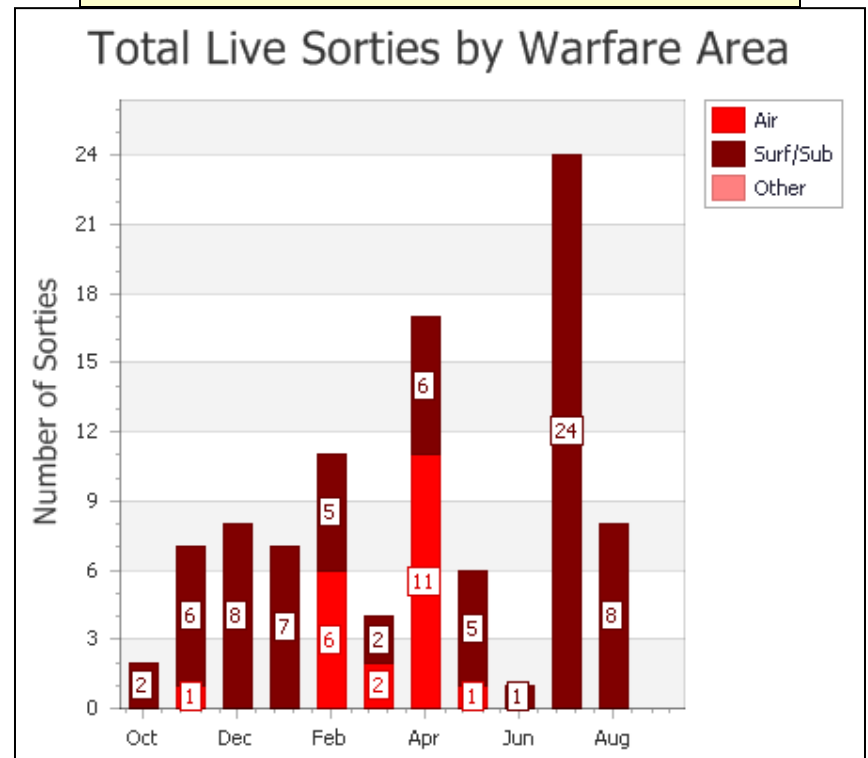
# W122 (5) Ordnance Expended Side-by-Side Comparison

Dashboard Report after partial data integration effort (Sep11)

TARAT with TRIMS & SHARP  
Data - FY09 Data



TARAT with TRIMS, SHARP, NAVSKED, TRMS  
& TORIS Data – FY10 Data

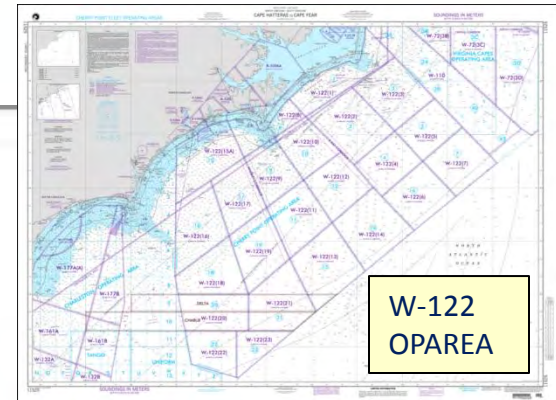
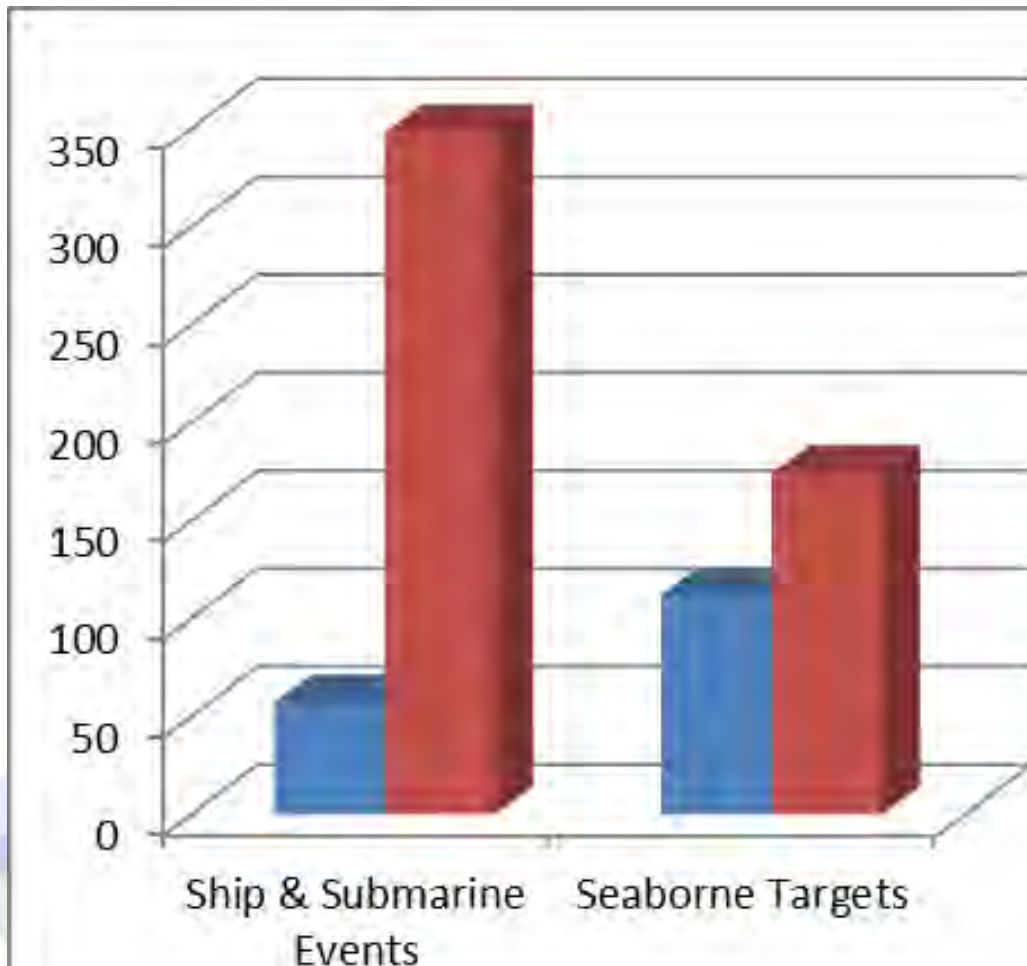


- Improvements over initial dashboard reports
- 'Ship Ordnance Expended' will slightly increase in TARAT with integration of USFF ATR data; will significantly increase with NOLSC data



# Decisions Being Made With Incomplete Data

## Ship Events & Seaborne Target Utilization



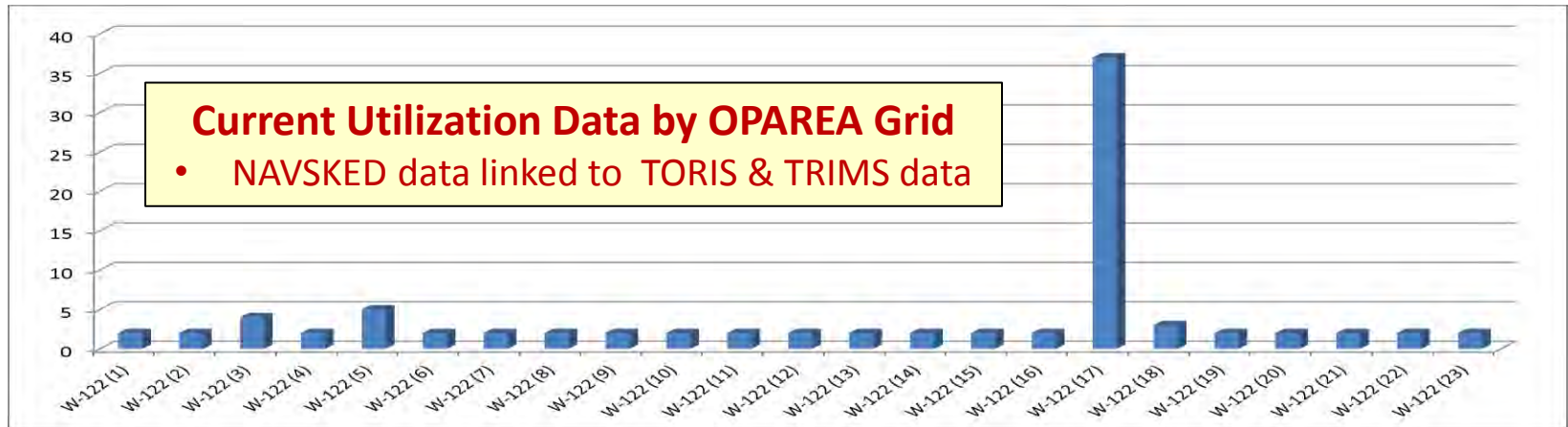
- Jun07-Sep10 (40 months)  
USFF TRIMS Data Ship  
Events W122
- 7Jul10 - 15Jul10 (9 Days)  
CSFTL Exercise Event Data  
Ship Events W122

**Decision Quality Data Needed & Not Available**



# W122 OPAREA Grid Use (7Jul10-15Jul10)

## USS KEARSARGE Expeditionary Strike Group Exercise



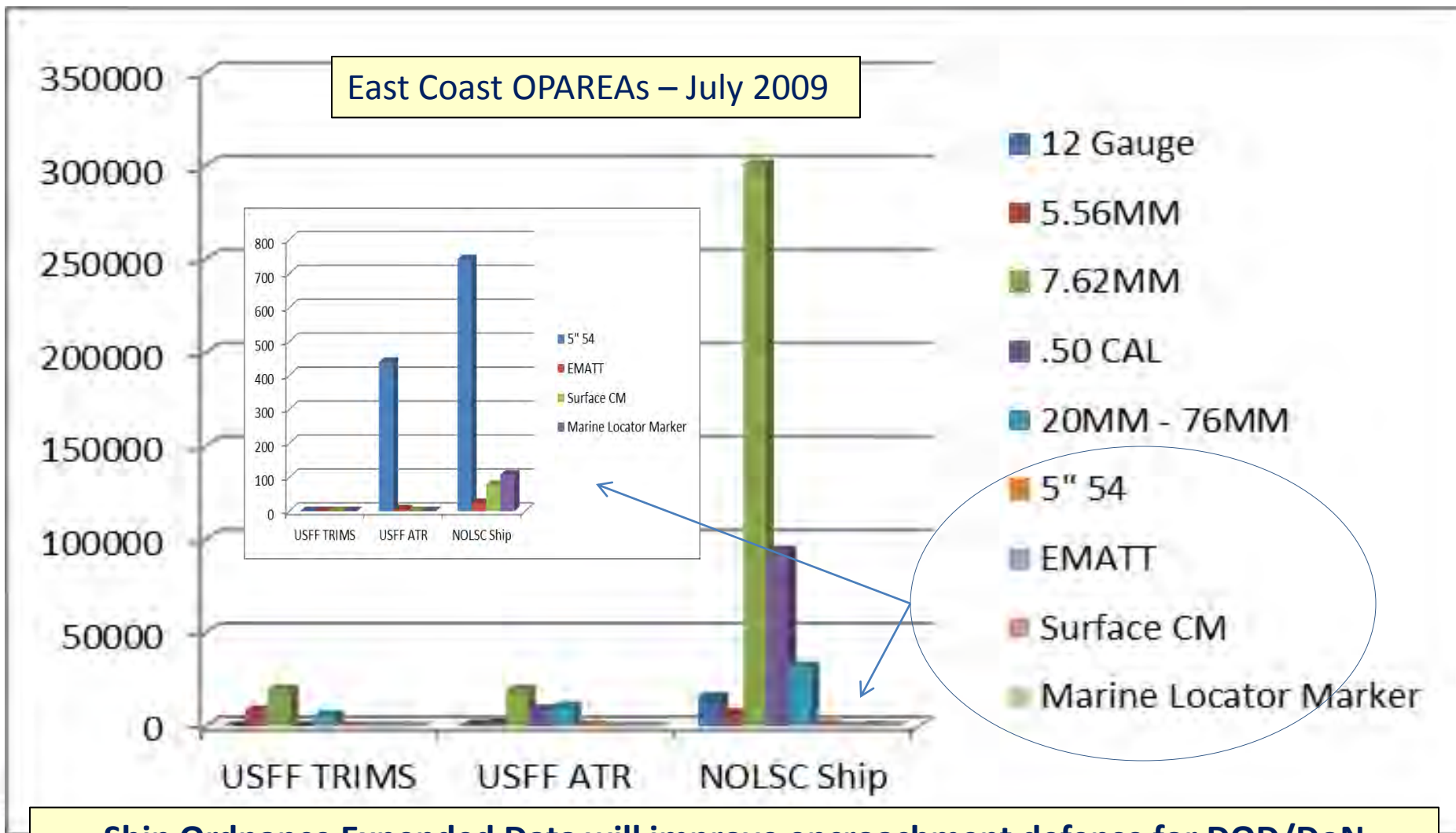
- USFF TRIMS records average of 4 ship events per grid over 9 days
- Exercise records average of 212 ship events per grid over 9 days





# Ship Ordnance Expended Data on LANT OPAREAs

## Comparison From Separate Databases



**Ship Ordnance Expended Data will improve encroachment defense for DOD/DoN**

- TRIMSV & USFF ATR slightly improve ship ordnance expenditure data (only record ~9%)







# N433 Range Sustainment Project

## Concept & Objectives

### Project Concept:

- Quantitatively determine Navy range complex contribution to readiness & better understand the linkages between readiness, range use and cost
- Link above data in an automated, sustainable & repeatable process
- **Improve DOD / DoN range encroachment defense**

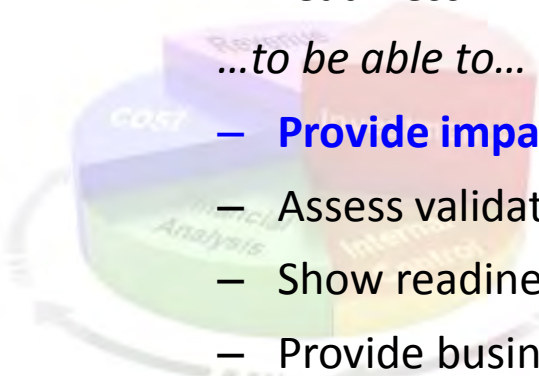
### Objectives:

*Do the following...*

- Align existing cost, readiness & utilization databases
- Create an assessment tool with reports to display range contribution to fleet readiness linked to utilization and cost

*...to be able to...*

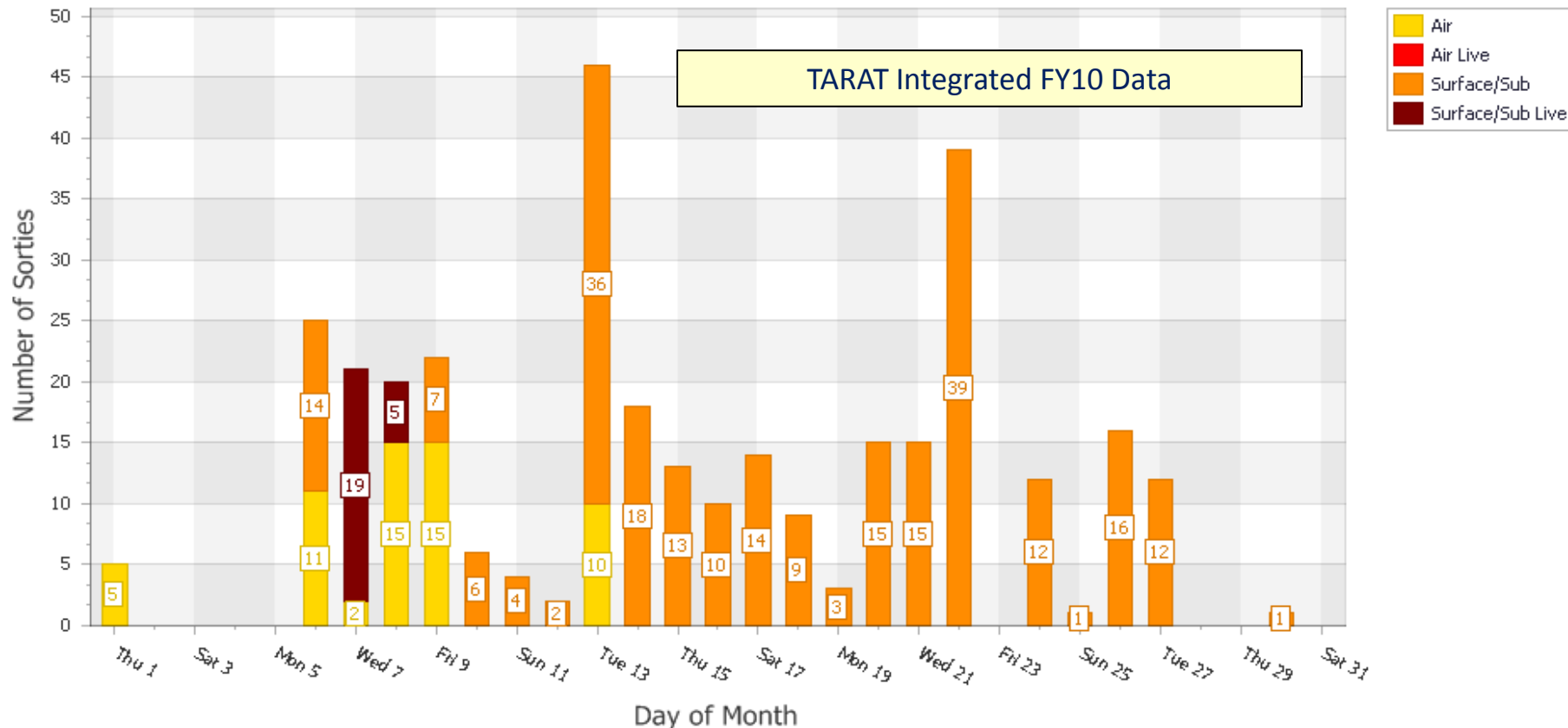
- **Provide impact analysis to defend against encroachment**
- Assess validated range resource requirements
- Show readiness impact of budget decisions
- Provide business case analysis to support POM build





# W122 (5) Utilization Day-by-Day Comparison

Total Sorties by Warfare Area



**Usage curve increases from FY09 to FY10 with additional data sources**

- Improvements over initial dashboard reports (less 'Blue' or 'No Use' days)
- 'Ship Events' will significantly increase with identified additional data





# Data Sources in TARAT

## Training Area & Range Assessment Tool

### **Larger Utilization Databases with Data Integrated in TARAT:**

- U.S. Fleet Forces (USFF) Range Utilization for Fleet Training
- Navy Air Readiness Reporting
- Navy Ship Readiness Reporting
- Fleet Area Control & Surveillance Facility (FACSFAC) Airspace Scheduling
- NAWC Test Range / MRTFB Utilization
- AUTECH T&E
- SCSC NASA / SCSC Wallops
- USFF ATR (Ordnance Expended)

### **Data being Integrated in TARAT:**

- ATMO Aerial & Seaborne Targets (East Coast only)
- AWIS Aerial Targets
- STAIRS Seaborne Targets
- Ship Electronic Support Evaluation Facility (SESEF)
- USMC RFMSS (only MCAS Cherry Point data at this time)
- NSWC PHD CSSQT data

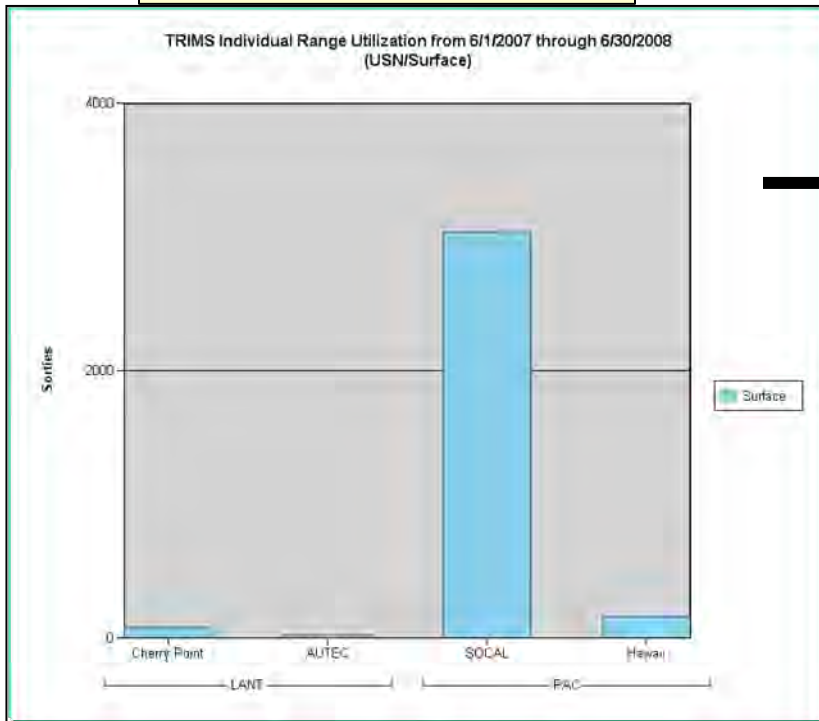
### **Future Expansion (FY12):**

- Ship Ordnance Expended
- Exercise Event data for Ships



# TARAT Level of Data Improving Exercise Event Data Will Give TARAT Density of Operations

**Thru Jun08 – No Ship Event  
Data Recorded on East Coast**



**After TORIS / NAVSKED Integration**

**W122 Ship Events Matched in TARAT (as of 29Sep11)**

Data Source	# Ship Events	# LHD/LPD/LSD Ship Events
TORIS	250	111
TRIMSV	145	75



**With Exercise Event Data  
Integrated in TARAT**

**W122 Ship Events Matched in TARAT**

Data Source	# Ship Events	# LHD/LPD/LSD Ship Events
CSFTL linked to NAVSKE/TRIMSV/Other Sources	990	420
CSFTL will also match hundreds of ship events / month for JAX & VACAPES OPAREAs		

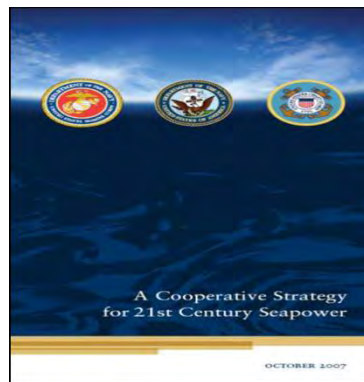
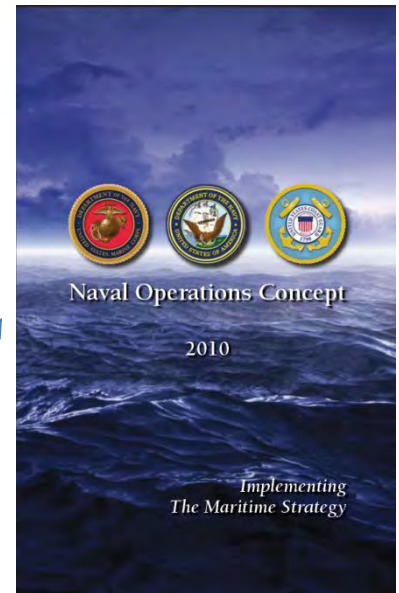
**Exercise Event Data Will Give TARAT Full Fleet Use of OPAREA Grids**

- Ability to Show 'Impact' to Loss of OPAREA Grid
- Will Provide 'Density of Operations' & Help Connect To Ship Ordnance Data



# Naval Operations Concept – 2010

- Describes how, when and where U.S. naval forces will contribute to preventing conflict and prevail in war in order to guide maritime strategy implementation
- “Naval” encompasses Navy, Marine Corps and Coast Guard personnel and organizations
- “Implements” the Maritime Strategy – organized around & expounds upon the six expanded core capabilities identified in the maritime strategy
  - Forward Presence
  - Deterrence
  - Sea Control
  - Power Projection
  - Maritime Security
  - HA / DR



Core Capabilities	Forward Presence	Maritime Security	HA/DR	Sea Control	Power Projection	Deterrence
<b>Naval Forces</b>						
Aircraft Carriers	X		X	X	X	X
Aircraft	X	X	X	X	X	X
Amphibious Ships	X	X	X	X	X	X
SSNs	X	X		X	X	X
SSGNs	X	X			X	X
SSBNs					X	X
Large Surface Combatants	X	X		X	X	X
Small Surface Combatants	X	X		X		
Major Cutters	X	X	X	X		X
Patrol Craft	X	X	X	X		X
Combat Logistics Force	X	X	X	X	X	
Hospital Ships	X		X			
Maritime Prepositioning	X		X		X	
JHSV	X	X	X			
Command and Support	X					
Logistics Support	X	X	X	X		X

**Navy ranges critical to platform and integrated readiness**

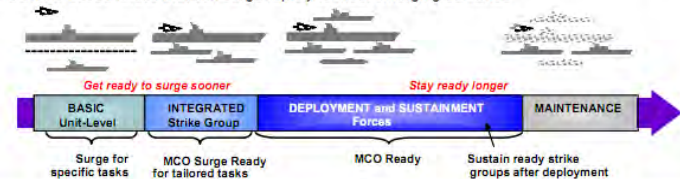
# Fleet Response Training Plan (F RTP)

- FRTP is the training cycle the units of a CSG accomplish to be deployment ready
- FRTP Phases
  - Maintenance, Basic (Unit Level), Integrated, Sustainment
  - CSG “Surge Ready” after completion of Integrated phase
- Major CSG FRTP Events
  - CVW Fallon (Air Wing Det)
  - Composite Training Unit Exercise (COMPUTEX)
  - Joint Task Force Exercise (JTFEX)

COMNAVAIRFORINST 3500.20C

## Fleet Response Plan (FRP) and Fleet Readiness Training Plan (FRTTP)

**FRP** sets the framework for providing Combatant Commanders with forward-deployed forces while maintaining additional CONUS-based forces that can surge rapidly to meet emerging demands



**FRTP** guides training throughout the FRP cycle. It controls which capabilities are trained and in what order. Major strike group training events prior to deployment are shown in the figure, which illustrates that FRTP involves both live and synthetic training.

### Fleet Synthetic Training (FST)

- In-port training on own equipment with electronic stimulation
- Enables complex training events on a larger scale and greater frequency than is feasible at sea
- Multi-unit and multi-warfare; mission rehearsal; joint interoperability: et al.

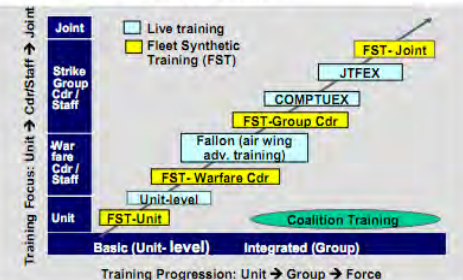


Figure 3-1 FRP - Fleet Response Plan

# Ship Ordnance Expended Data on LANT OPAREAs

## NOLSC vs. TRIMS vs. USFF ATR Comparison

### USFF ATR Data LANT OPAREAs - Jul09

USFF ATR Ship Ordnance Expenditures for CP, JAX & VC OPAREAs (Jul10)			
Munition Type	Total Rounds By Type	ASW / USW Sonar Use	Hours Used
12GA	640	SLQ-25	8.42
20MM CIWS	2840		
20MM DS	5389		
25MM SAPHEI-T	825		
40MM HE-DP	954		
76MM BL-P	108		
C-4 CHARGE (1-1/4 LB)	34		
5.56MM	1180		
5/54 BL-P	221		
5/54 HE-CVT	76		
5/54 ILLUM	159		
7.62MM GRENADE	4		
7.62MM T	14373		
9MM	4923		
BOMB 500LB GEN PURP	10		
CAL.50 T	8900		
EMAT	5		
SIMULATOR FLARE	381		
Total Ordnance Expended (Jul10)	41,022	Source: USFF ATR	

### TRIMSV Data LANT OPAREAs - Jul09

TRIMS Ship Ordnance Expenditures for CP, JAX & VC OPAREAs (Jul10)				
LHD-3	LHD	W-122 (17)	20MM	5780
LHD-3	LHD	W-122 (17)	7.62MM	19600
LHD-3	LHD	W-122 (17)	.50 CAL	8400

### NOLSC Data LANT OPAREAs - Jul09

(Initial Look) NOLSC Ship Ordnance Expenditure Data for CP, JAX & VC OPAREAs (Jul10)		
Munition Type	Total Rounds By Type	Description / Added Detail
12GA	15505	
20MM CIWS 20MM DS 25MM SAPHEI-T 40MM HE-DP 76MM BL-P C-4 CHARGE (1-1/4 LB)	31927	OSG / Pyro / Grenades
5.56MM	6873	Small Arms 5.56 - 9MM, 22/30/38/45 Cal, Mines
5/54 BL-P 5/54 HE-CVT 5/54 ILLUM	742	Also 751 Charge/Propellant, 458 MK199 Mod1
7.62MM GRENADE 7.62MM T 9MM	300,349	Small Arms 5.56 - 9MM, 22/30/38/45 Cal, Mines
BOMB 500LB GEN PURP	60	
CAL.50 T	93697	Small Arms 5.56 - 9MM, 22/30/38/45 Cal, Mines
EMAT	23	
SIMULATOR FLARE	0	Could Not Associate Entry in NOLSC
SURFACE CM	77	None of these entries were found in TRIMV or USFF ATR Ordnance Expended Data
CADS/PADS/AEPS	2	
SUS	1	
MK46 (5) TORP / EXTORP	1	
5" ROCKETS	5	
LGB	6	
MARINE LOCATION MARKER	107	
Total Ordnance Expended (Jul10)	449,375	Source: NOLSC

**NOLSC Data will provide 'full impact' picture for DOD / DoN in encroachment defense**

- TRIMSV & USFF ATR have slightly improved ship ordnance expenditure data since 2009
  - Still only record ~9% of actual expenditures





# National Ocean Policy Priority Objectives

## [www.whitehouse.gov/oceans](http://www.whitehouse.gov/oceans)

### National Priority Objectives

1. **Ecosystem-Based Management:** Adopt ecosystem-based management as a foundational principle for the comprehensive management of the ocean, our coasts, and the Great Lakes.
2. **Coastal and Marine Spatial Planning:** Implement comprehensive, integrated, ecosystem-based coastal and marine spatial planning and management in the United States.
3. **Inform Decisions and Improve Understanding:** Increase knowledge to continually inform and improve management and policy decisions and the capacity to respond to change and challenges. Better educate the public through formal and informal programs about the ocean, our coasts, and the Great Lakes.
4. **Coordinate and Support:** Better coordinate and support Federal, State, tribal, local, and regional management of the ocean, our coasts, and the Great Lakes. Improve coordination and integration across the Federal Government, and as appropriate, engage with the international community.
5. **Resiliency and Adaptation to Climate Change and Ocean Acidification:** Strengthen resiliency of coastal communities and marine and Great Lakes environments and their abilities to adapt to climate change impacts and ocean acidification.
6. **Regional Ecosystem Protection and Restoration:** Establish and implement an integrated ecosystem protection and restoration strategy that is science-based and aligns conservation and restoration goals at the Federal, State, tribal, local, and regional levels.
7. **Water Quality and Sustainable Practices on Land:** Enhance water quality in the ocean, along our coasts, and in the Great Lakes by promoting and implementing sustainable practices on land.
8. **Changing Conditions in the Arctic:** Address environmental stewardship needs in the Arctic Ocean and adjacent coastal areas in the face of climate-induced and other environmental changes.
9. **Ocean, Coastal, and Great Lakes Observations, Mapping, and Infrastructure:** Strengthen and integrate Federal and non-Federal ocean observing systems, sensors, data collection platforms, data management, and mapping capabilities into a national system, and integrate that system into international observation efforts.

- Priority/Objective number two is the most important near term concern
- Priority/Objective nine may have implications for TARAT long term use by the Navy

# CMSP Goals

## The National Goals of Coastal and Marine Spatial Planning

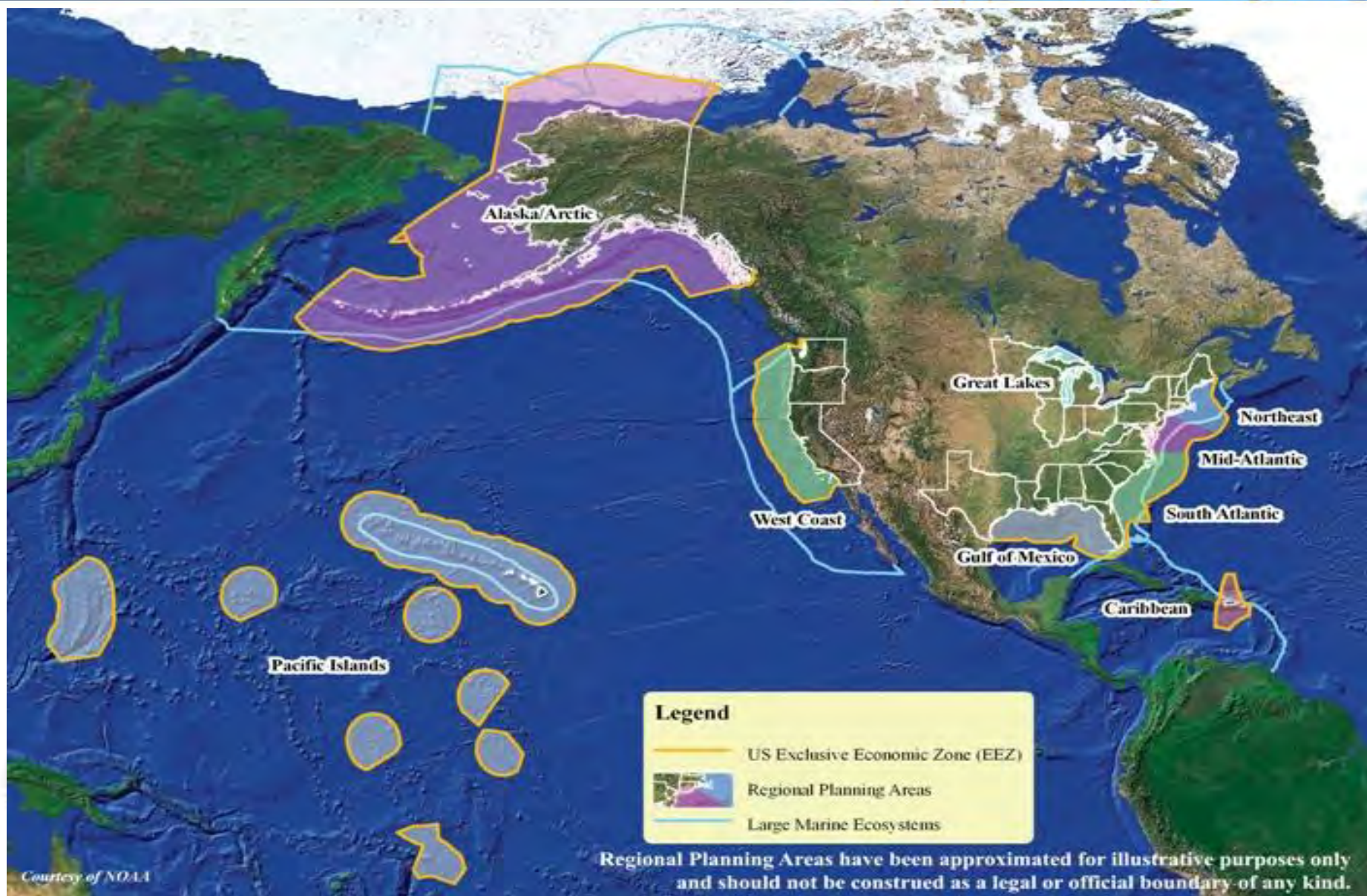
1. Support sustainable, safe, secure, efficient, and productive uses of the ocean, our coasts, and the Great Lakes, including those that contribute to the economy, commerce, recreation, conservation, homeland and national security, human health, safety, and welfare;
2. Protect, maintain, and restore the Nation's ocean, coastal, and Great Lakes resources and ensure resilient ecosystems and their ability to provide sustained delivery of ecosystem services;
3. Provide for and maintain public access to the ocean, coasts, and Great Lakes;
4. Promote compatibility among uses and reduce user conflicts and environmental impacts;
5. Improve the rigor, coherence, and consistency of decision-making and regulatory processes;
6. Increase certainty and predictability in planning for and implementing new investments for ocean, coastal, and Great Lakes uses; and
7. Enhance interagency, intergovernmental, and international communication and collaboration.

- Goal seven assumes metrics and data (scientific basis) for communication and collaboration

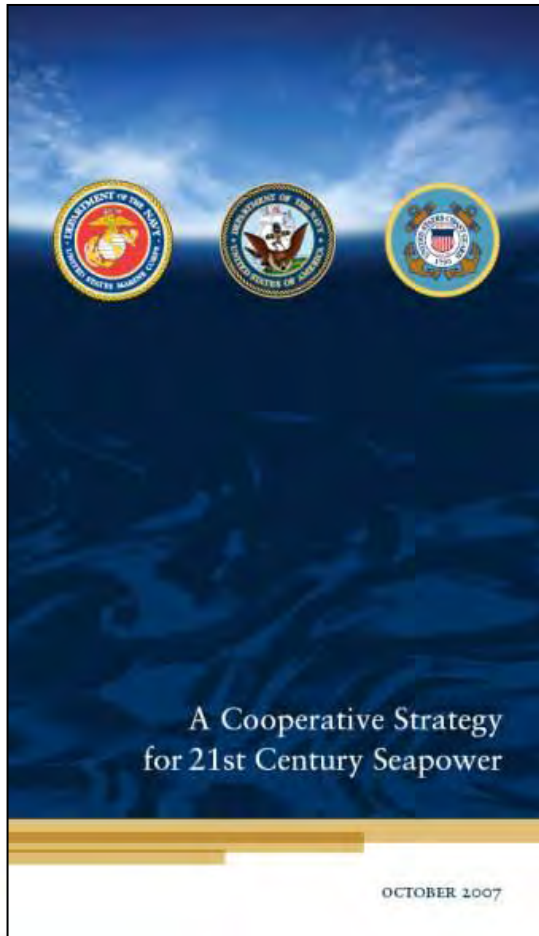




# CMSP Management Regimes



# The Maritime Strategy



## National Strategic Imperatives:

1. *Limit regional conflict with forward-deployed, decisive maritime power*
2. *Deter major power war*
3. *Win our Nation's wars*
4. *Contribute to homeland defense in depth*
5. *Foster & sustain cooperative relationships with more international partners*
6. *Prevent or contain local disruptions before they impact the global system*

## Core Capabilities of the Maritime Strategy:

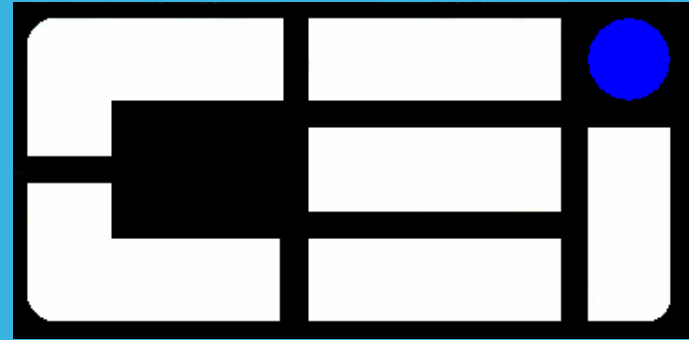
1. *Forward Presence*
2. *Deterrence*
3. *Sea Control*
4. *Power Projection*
5. *Maritime Security*
6. *Humanitarian Assistance and Disaster Response*

**Core Fleet Response Plan training range requirements drive usage and utility of ranges for the Navy and U.S. National Security**



# Composite Engineering Inc.

The High Performance  
Aerial Target Company



## Subsonic Aerial Target System (SSAT)

# BACKGROUND

**The Navy uses aerial targets as surrogates of Anti-Ship Cruise Missile (ASCM) threats to:**

- Test the effectiveness of shipboard Air Defense systems
- Train Fleet forces in the use of Air-to Air Missile (AAM)
- Train Surface-to-Air Missile (SAM) systems.

**The SSAT represents the subsonic class of ASCM threats in support of Test and Evaluation (T&E) of weapons systems acquisition programs.**



# KEY PERFORMANCE PARAMETERS

The Design Meets or Exceeds all KPP's

Key Performance Parameters	Threshold	Objective	SSAT Projected Performance
Maximum Speed at Low Altitude [Mach (M) at feet (ft) above wave crest at WMO Sea State (SS) conditions]	0.90 M @ 10.0 ft @ SS 3	0.95 M @ 6.6 ft @ SS 5	0.90M @ 6.6ft, 0.95M @ 10ft SS3
Minimum Altitude [ft above wave crest]	10.0 ft @ 0.90M @ SS 3	6.6 ft @ 0.95M @ SS 5	0.90M @ 6.6ft, 0.95M @ 10ft SS3
Maneuverability [Constant Gravitational Force (g)]	6.0 g @ 500 ft	8.0 g @ 500 ft	8.0 g @ 500 ft, 50% fuel
Maneuverability During Programmable Weave at Minimum Altitude and Maximum Speed [Instantaneous g]	1.0 - 6.0 g	1.0 - 8.0 g	1.0 - 8.0 g
Target Size Characteristics [inches] [Dimensions During Target Presentation] Length Diameter	149.0 - 258.0 inches 13.0 - 21.0 inches	No Objective Requirement	207 inches 19.6 inches
Radar Cross Section (RCS) Reduction [X-band, monostatic] [Decibels per square meter (dBsm)]±2 dBsm	[-14.6, -10.0, -3.0, 0.0 dBsm] ±2 dBsm	-17.0 dBsm ±2 dBsm	Threshold
Material Availability ( $A_M$ )	0.85	0.95	0.85

# KEY SYSTEM ATTRIBUTES

The Design Meets or Exceeds all KSA's

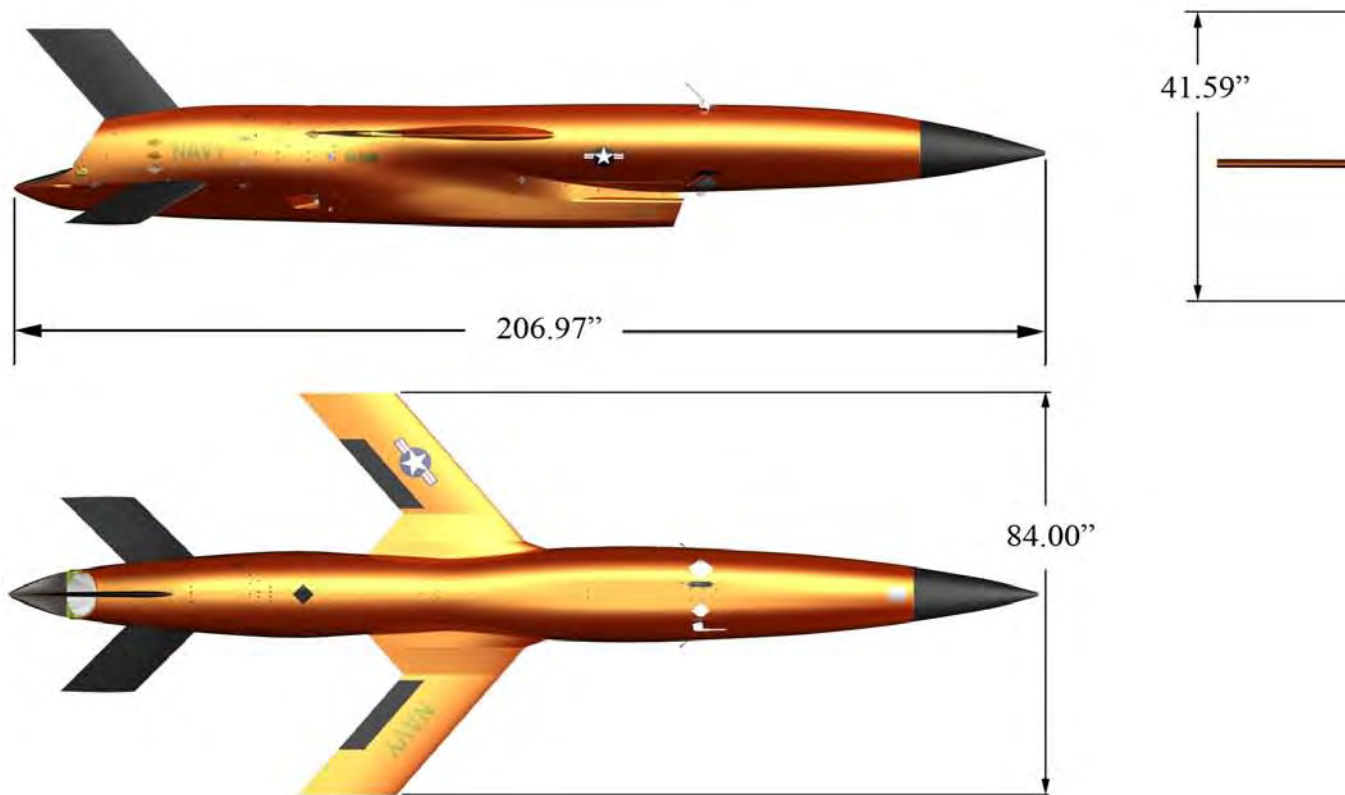
Key System Attributes	Threshold	Objective	SSAT Projected Performance
Reliability ( $R_M$ )	0.94	0.98	0.94
Range [nautical miles (nmi)] At most efficient speed at 20,000 ft (Kft) At 0.90M at 50.0 ft Above Ground Level (AGL)	300 nmi 150 nmi	400 nmi 200 nmi	400 nmi 200 nmi
Endpoint Accuracy [Fixed and Moving]	$\pm 100$ ft	$\pm 25$ ft	$\pm 100$ ft
Air Vehicle Retrieval Mode	Land and Sea	NR	Land and Sea
Service Life –Air Vehicle [number of flights (flts)]	20 flts	30 flts	30 flts
Turn-Around Cost [Fiscal Year (FY) 08 \$]	\$11,000	\$ 9,500	\$11,000



# KEY VEHICLE SPECIFICATIONS

Length	207 inches
Wingspan	84 inches
Range	217 nmi @ 0.9M, 50 ft. (KPP); 576 nmi @ 400 KTAS, 20k ft. (KPP); 800+ nmi @ 30k ft.
Altitude	6.6 ft AGL – 45k ft MSL
Speed	0.45 – 0.96 Mach @ SL (KPP); Maximum: 1.1 Mach @ 40k ft. MSL
Endurance	120+ min. @ 30k ft.; 22 min @ 0.9M, 50 ft.
Dry Weight	531 – 653 lb.
Fuel Capacity	62 gal.
Max Launch Weight	1,350 lb. w/o RATOs
Engine Thrust	1,000 lb Static Sea level
Fuel	JP-8, JP-5, or Jet-A

# OVERALL DIMENSIONS



# TARGET SIZE COMPARISON

SSAT

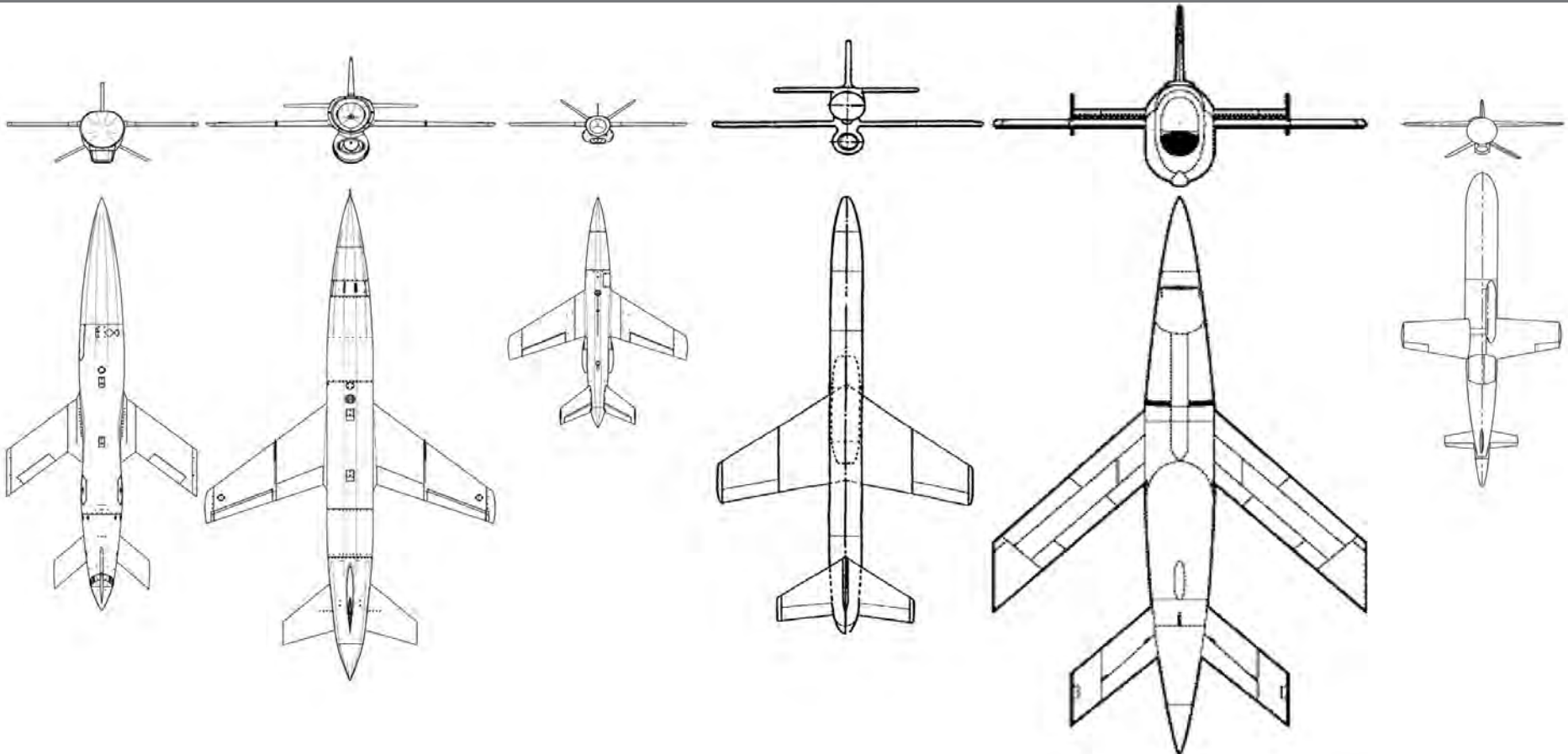
BQM-167A

FireJet

MQM-107

BQM-34

BQM-74



SSAT is the replacement for the BQM-74E and BQM-34S targets.

# SURFACE LAUNCHER

- The Combined Transport Launch Rail (CTLR) provides multiple functions:
  - Vehicle Transportation
  - Engine Run Test Stand
  - Launch Platform
  - Maintenance Platform
- RATO Assembly
  - Controlled, Predicable Separation
  - Insensitive to misalignment
- The RATO firing assembly is the same GFE as used for the BQM-74E



Combined Transport Launch Rail (CTLR) Assembly



RATO Assembly



RATO Firing Assembly

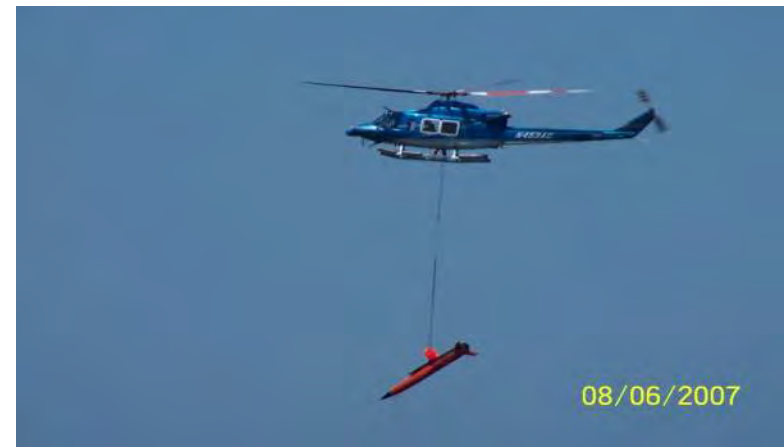


# FLOATATION / HELO TOW

High strength Kevlar® retrieval loop integrated into a water activated flotation bag



Attachment point provides good attitude for high speed towing- no need for a stabilizing chute




SPOT Personal Tracker with an internal battery mounted with our flotation bag



# SSAT PROGRAM SCHEDULE

Task Name	2011				2012				2013				2014		
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
SETR EVENTS															
PROGRAM EVENTS															
DT-B1A															
DT-B1B															
DT-B2															
TESTING EVENTS															
LOG EVENTS															

# **PROGRAM PROGRESS TO DATE**

- **Completed - Systems Requirements Review (SRR) as part of the Systems Engineering Technical Review (SETR) Process**
  - **Completed - Wind Tunnel Testing**
  - **Completed - Aerobatic testing of the CEi Navigation System**
  - **85% complete - air vehicle design**
  - **95% complete - tooling designs**
  - **60% complete - composite tools fabrication**
  - **Began manufacturing of the first Test and Flight Targets**
  - **Began HW/SW Integration**
- 



Army Test and Evaluation Command

Army Test and Evaluation Command



# NDIA Symposium

**Allen Tyler**  
**Threat Coordinator, ATEC G-9 / Test Management**

Army Proven  
Battle Ready

Army Proven  
Battle Ready



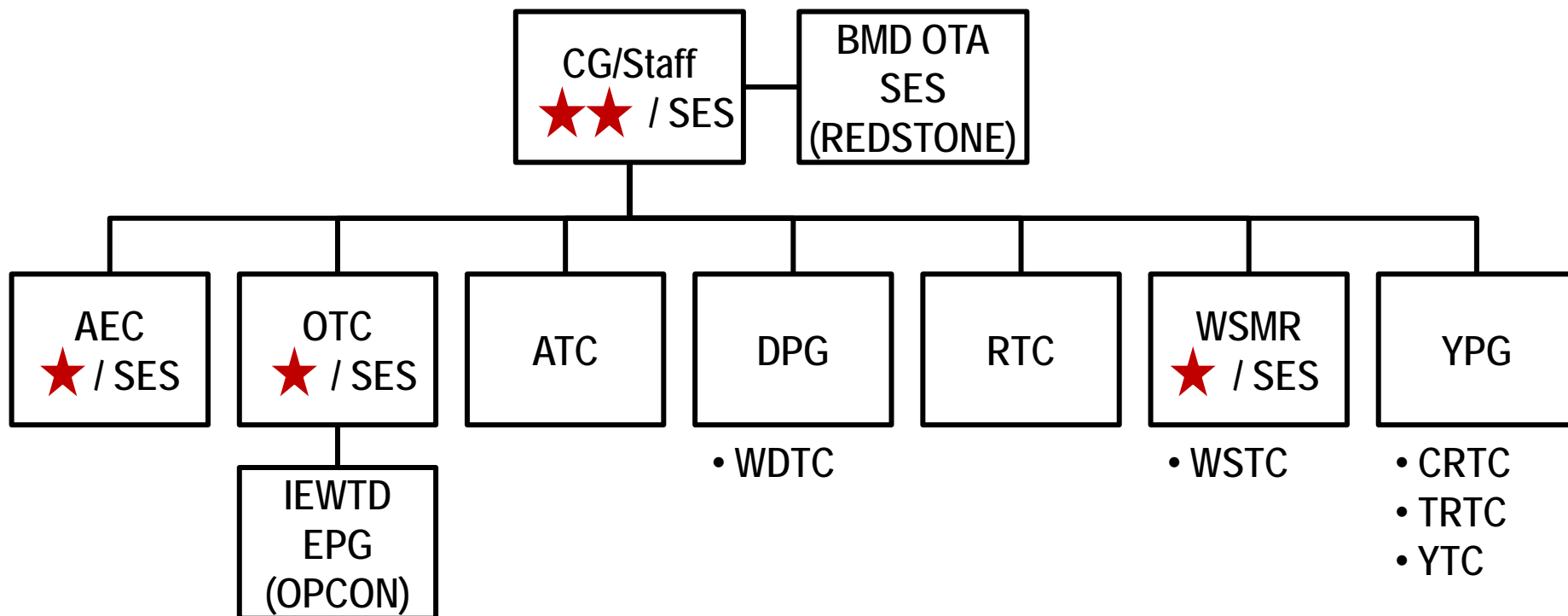
# Agenda

- New ATEC address
- ATEC Reorg
- Rapid Equip vs Title X
- AGILE
- Summary

# New ATEC HQ



# ATEC Reorganization



ATEC: Army Test Evaluation Command

DTC: Developmental Test Command

OTC: Operational Test Command

AEC: Army Evaluation Center

BMD: Ballistic Missile Defense

OTA: Operational Test Agency

WDTC: West Desert Test Center

WSTC: White Sands Test Center

CRTC: Cold Regions Test Center

TRTC: Tropical Regions Test Center

YTC: Yuma Test Center

IEWTD: Intelligence Electronic  
Warfare Test Directorate

ATC: Aberdeen Test Center

DPG: Dugway Proving Ground

EPG: Electronic Proving Ground

RTC: Redstone Test Center

WSMR: White Sands Missile Range

YPG: Yuma Proving Ground

## Rapid Equipping

- Quick, overlapping
- Higher Risk
- Opportunistic/ Ad hoc
- Less bureaucratic & little oversight
- Proponent & Community of the Willing
- Incomplete Data
  - Constrained DT
  - Limited OT
  - C&L Report to User
- Cheap to Community –  
Expensive to ATEC

## Title X, DoD 5000, etc.

- Deliberate
- Risks Mitigated
- Fully Synchronized
- Bureaucratic & oversight
- Full Community involvement
- All data
  - Robust DT
  - Full OT
  - OMAR/OER to MDA
- Expensive to Community

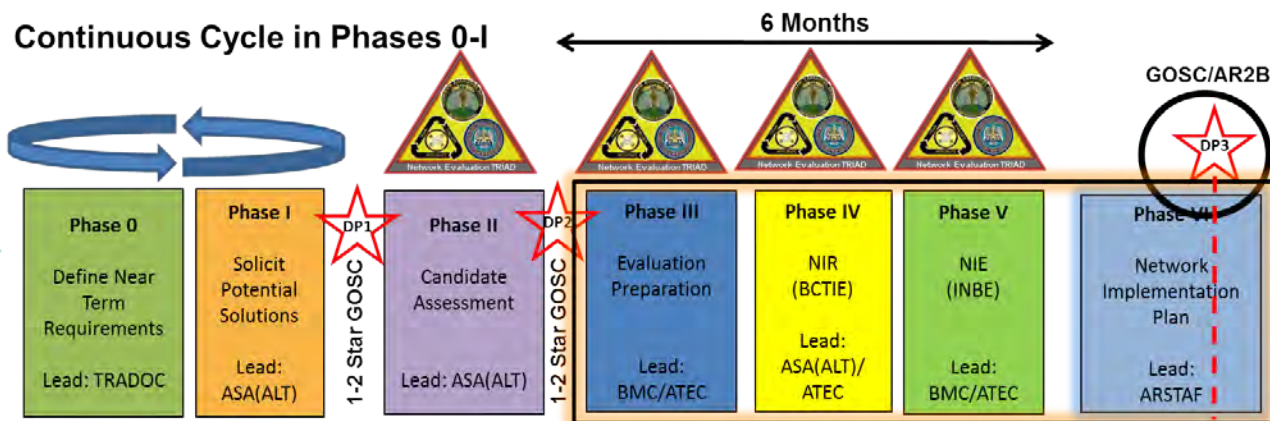




# Army Agile Process – Briefly

To shape the Development, Integration, Test and Certification of the Network for Success:

- Common understanding of desired capabilities, limitations and system requirements
  - Enables ability to know how to test; cost of test (dollars and risk); and creates early dialogue between stakeholders
- Common set of “core” vignettes based on “in-the-dirt” testing
  - Facilitates Model-Test-Model approach, and understanding of “baseline” conditions under which system must perform
- Common set of “core” measures
  - Allows for reuse of data, promotes similarities in findings and results, and improvements to processes
- Data Model
  - Ensures reuse of data, clear understanding of measures and data elements to be collected, and analytic consistency between test events and capability sets



## G-3/5/7 Lead

- DP 1 - Viable Candidate List
- DP 2 - Candidates Selected for Evaluation
- DP 3 - Solution Implementation Plan

# Summary

- HQ ATEC is now located on APG MD
- Brand new building
- Reorganized
- Implementing efficiencies in T&E thru AGILE process

# Questions?

# Directed Energy Test & Evaluation Capability 10 Years Later



**26 October 2011**

**Doug Weatherford**  
Senior Advisor, PEO STRI SETA Team

**NDIA Targets, UAVs & Range Ops Symposium**  
Ft Walton Beach, FL





# Overview

- DETEC Mission and History
- Tri-Service Study Shortfalls
- Capabilities Developed
- DET S&T and DETEC Interaction
- Additional Successes
- Tri-Service Study 2011
- Summary



# DETEC Mission



Funded by TRMC's Central Test and Evaluation Investment Program

- Develop Joint T&E MRTFB infrastructure required for T&E of DEW systems
  - Instrumentation
  - Equipment
  - Software tools
- DEW systems supported
  - High energy laser (HEL)
  - High power microwave (HPM)
- Coordinate T&E needs with TRMC S&T efforts



**DETEC** – Directed Energy Test and Evaluation Capability

**MRTFB** – Major Range and Test Facility Base

**DEW** – Directed Energy Weapon

**TRMC** – Test Resource Management Center

**T&E** – Test and Evaluation



# DETEC History

**T-SS Begins**  
to identify and  
scope shortfalls in  
DE T&E  
infrastructure

**T-SS Update (2007) Begins** to  
capture current DE T&E  
infrastructure shortfalls for  
DETEC II, originally planned to  
start in 2010

**T-SS 2011 Begins**  
to capture most current DE T&E  
infrastructure shortfalls for DETEC II,  
now projected for consideration to  
start in the 2012-2014 timeframe

2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014

**DETEC Effort  
Proposed to CTEIP**

**DETEC Begins** to resolve 12 high priority capabilities  
identified by the T-SS. DETEC is developing 16 systems  
(covering 40 shortfalls) to address these infrastructure  
shortfalls

**DET S&T Begins** to address high-risk, high-pay-off shortfalls  
identified by the T-SS. To date, DET S&T has delivered 20  
projects

**Projected Window** for  
Services/TRMC to consider  
resolving the highest priority  
shortfalls identified by the T-SS  
2011



# DETEC Tri-Service Study (2004)

## High Priority Shortfalls

DETEC program to develop 12 Synergies covering 32 shortfalls

### High Energy Laser (HEL)

- Ground Target Irradiance Measurement (GTIM) – H1
- Airborne Target Irradiance and Imagery Measurement (ATIM) – H3
- Target Subsystems Protection (TSP) – H5
- Target Surface Temperature Measurement (TSTM) – H11
- Target Reflected Energy Measurement (TREM) – H12

### High Power Microwave (HPM)

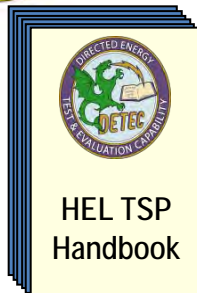
- Sensor Suite (SS) – H2
- Propagation Environment Measurement (PEM) – H4
- Test Target Subsystems Surety (TTSS) – H6
- Target Surrogate Materials (TSM) – H7
- Narrowband Threat Systems (NBTS) – H8
- Test Hazard Prediction (THP) – H9
- Wideband Threat Systems (WBTS) – H10





# DETEC Capabilities Overview

DETEC actually developed 16 solutions addressing 40 T-SS shortfalls:



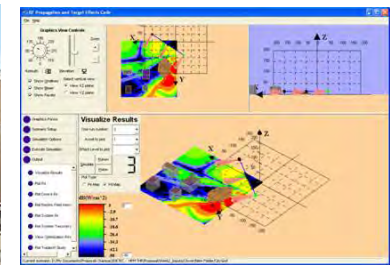
**HEL TREM**



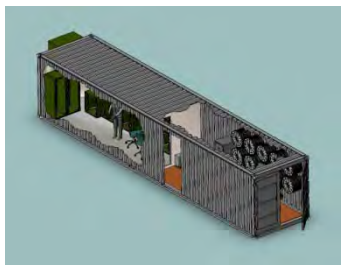
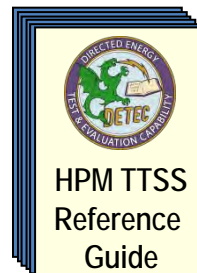
**HEL GTIM**



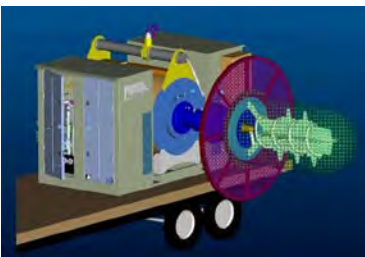
**HEL ATIM**



**HPM THP**



**HPM SS**



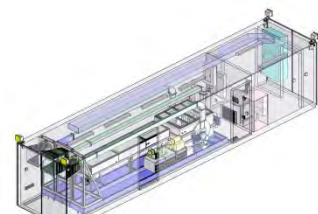
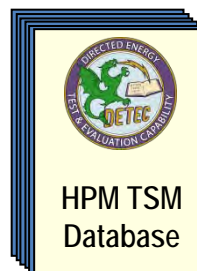
**HPM WBTS**



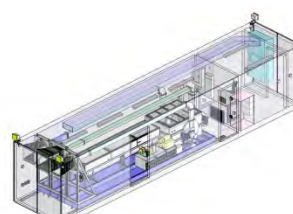
**HPM COTS WBTS (2)**



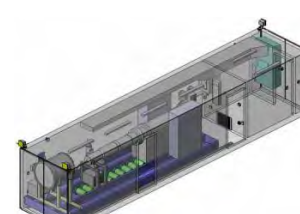
**HPM PEM**



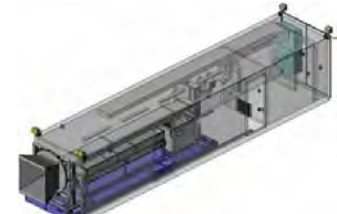
**HPM NBTS-A**



**HPM NBTS-A'**



**HPM NBTS-B**



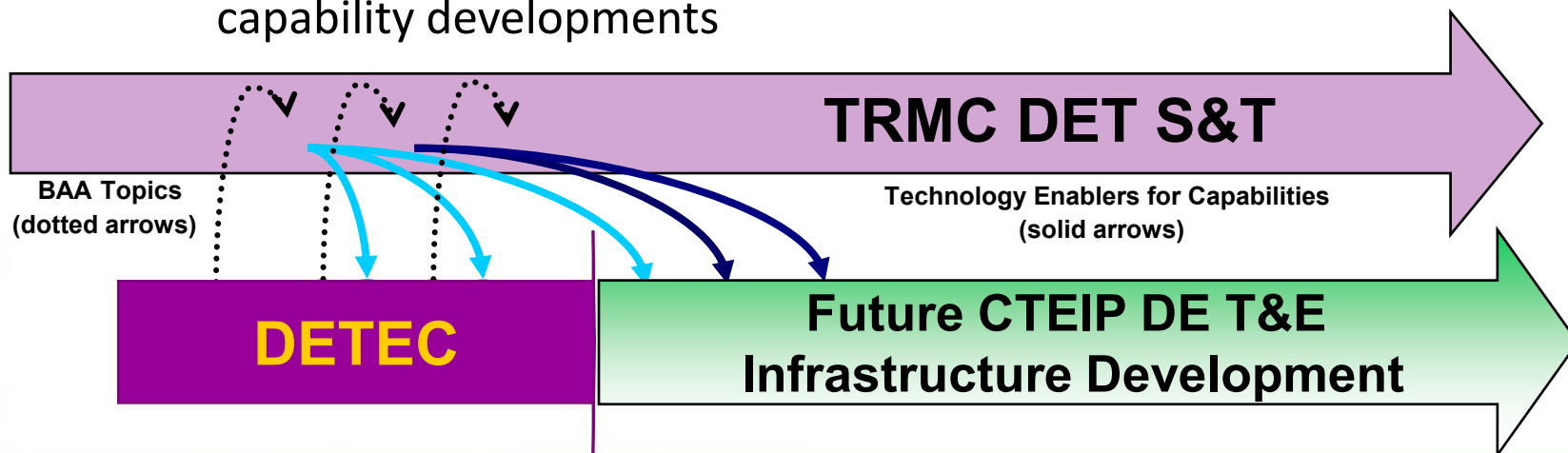
**HPM NBTS-C**

\* - Purple text indicates additional sources delivered





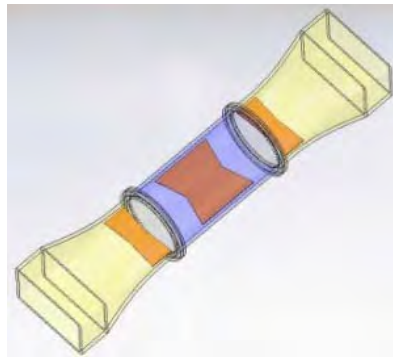
# DET S&T Interaction with DETEC

- **TRMC DET S&T and DETEC under common management**
  - DETEC uses risk reduction requirements for planned capability developments as S&T BAA topics
  - DETEC uses and augments existing IPT structure to generate future S&T topic needs that support capability development timeline
  - DETEC announces annual BAA issued by DET S&T with updated topics
  - DETEC leverages DET S&T projects as risk reductions for DETEC capability developments





# DET S&T Enhancements for HPM NBTS

Rotating Step-Twist Polarizer (RSTP)	Resistive Waveguide Attenuator (RWA)	Microwave Rotary Attenuator (MRA)
		
Rotating step-twist polarizer that enables polarization change without the delays associated with breaking vacuum	Automatic, continuously adjustable attenuator from 0 to ~18 dB, for installation in high-power high-vacuum environment	Enables user to continuously and dynamically vary power output by 0 to ~15 dB
Installed in HPM NBTS-A'3	Installed in HPM NBTS-B	Installed in NBTS-C





# DETEC Capability Support to Major Tests



HPM NBTS-A



HPM NBTS-A'



HPM NBTS-C

HPM Narrowband Threat Systems are in frequent use at WSMR for multi-Service test requirements. Includes numerous Army vehicles, Brigade Combat Team modernization programs, and AFRL projects. Also, the Navy extensively uses the HPM SWBTS2 for aircraft systems.



HPM SS  
Shield  
Room



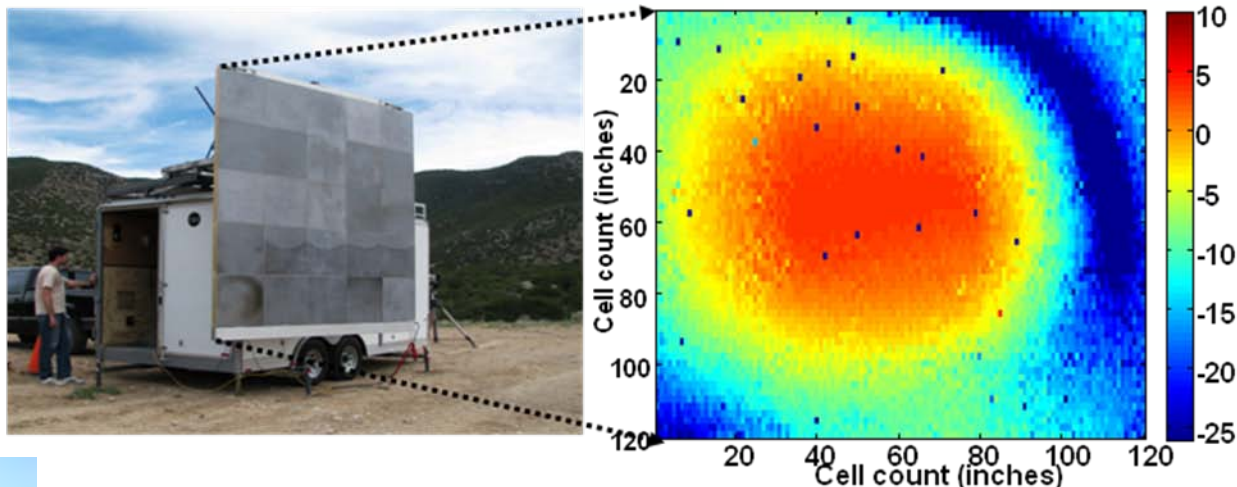
HPM SS  
used with  
HPM WBTS

HPM Sensor Suite used with threat systems testing both around and in test articles.





# DET Deliverables Support to Major Tests



Scanning Target Board (STB) used to characterize ADS beam shape at High Energy Test Research Facility, Kirtland AFB



HPM Soil Electrical Properties (HSEP) Brass Board in use at CHAMP initial test location to measure actual soil electrical properties to support modeling.



# T-SS 2011

- **Objective:** Identify and prioritize T&E shortfalls for DE systems planned to enter test in the next 12 years
- Conducted 7-step process to identify DE requirements, existing capabilities, and shortfalls
- Strong participation from Army, Navy, and Air Force throughout the process, including Service
  - Research Laboratories
  - Program/Demonstrator Offices
  - Operational Test Organizations
  - Senior Leadership
- FOUO version available via requests at “[detecteam.org](http://detecteam.org)”



# T-SS 2011 High Priority Capability Shortfalls

#	Domain	Capability Shortfall
1	HPM	Non-intrusive E-field and B-field probes*
2	HPM	X-band surrogate narrowband threat source*
3	HEL	Continuous Wave (CW) irradiance measurement on surface moving target board, towed airborne target board, and actual target*
4	HPM	C-band surrogate narrowband threat source*
5	HPM	Multiple node wireless data acquisition system*
6	HEL	Imagery of airborne targets*
7	HEL	Front target surface temperature*
8	HEL	Dynamic hazard analysis tool (M&S)
9	HEL	Predictive avoidance and airspace deconfliction tools (M&S)
10	HPM	Beam propagation in and near surfaces (M&S)
11	HPM	Test Hazard Prediction (THP)/Builder integration (M&S)

\* Technology investments made through DET S&T program could potentially be leveraged in acquiring a solution to this shortfall.



# Summary

## ***ACCOMPLISHMENTS:***

- Improved MRTFB infrastructure supporting DEW T&E
  - Addressed 40 of 88 original T-SS shortfalls
  - Delivered 4 HEL and 12 HPM capabilities
  - All hardware capabilities transportable between ranges
  - Reference Guides and Software tools distributed widely
  - Integrated several S&T projects improving performance/usability

## ***PATH FORWARD:***

- Recently completed T-SS 2011 Update
  - Identified 11 High Priority Capabilities for CTEIP consideration
  - Identified 16 S&T topics for Test Resource Management Center and Service 'reliance process' consideration





# Acronyms

APT – Advanced Pointer Tracker  
APOS – Advanced Polymer Optical Sciences  
ATIM – Airborne Target Irradiance and Imagery Measurement  
BAA – Broad Area Announcement  
BOIS - Bi-Static Optical Imaging Sensor  
BITS - Beam Irradiance on Target Systems  
CCB – Configuration Control Board  
COTS – Commercial-off-the-Shelf  
CTEIP - Central Test and Evaluation Investment Program  
CW – Continuous Wave  
DE – Directed Energy  
DET – Directed Energy Test  
DETEC – Directed Energy Test and Evaluation Capability  
DEW – Directed Energy Weapon  
DoD – Department of Defense  
DT&E – Developmental Test and Evaluation  
FTS – Flight Termination System  
GTIM – Ground Target Irradiance Measurement  
HEL – High Energy Laser  
HELSTF – High Energy Laser Systems Test Facility  
HPM – High Power Microwave  
IEMS - Integrated Electro-Magneto-Optic Sensor  
IPT – Integrated Product Team  
LCSP – Life Cycle Support Plan  
LFT&E – Live Fire Test and Evaluation  
MRA - Microwave Rotary Attenuator  
MRTFB – Major Range and Test Facility Base  
M&S – Modeling and Simulation  
MSWG – Modeling and Simulation Working Group  
NBTS – Narrowband Threat Systems  
OT&E – Operational Test and Evaluation

OTICC - Office of the Secretary of Defense Test Investment Coordinating Committee  
PD – Project Director  
PEM – Propagation Environment Measurement  
PEO STRI - Program Executive Office for Simulation, Training, and Instrumentation  
RAM - Rockets, Artillery, Mortars  
RF – Radio Frequency  
RFI – Request for Information  
RFP – Request for Proposal  
SAIC – Science Applications International Corporation  
SHEF - Skin Heating/Electric Field Strength Measurement  
SIC – Systems Integration Contractor  
SME – Subject Matter Expert  
SMFS - Spectrographic Magnetic Field Sensor  
S&T – Science and Technology  
SRG – Senior Review Group  
SS – Sensor Suite  
STB - Scanning Target Board  
TAOS - T&E Adaptive Optics System  
T&E – Test and Evaluation  
THP- Test Hazard Prediction  
TISM - Temperature and Irradiance Sensory Matrix  
TREM – Target Reflected Energy Measurement  
TRMC – Test Resource Management Center  
TSM – Target Surrogate Materials  
TSP – Target Subsystems Protection  
T-SS – Tri-Service Study  
TTSS – Test Target Subsystems Surety  
WBTS – Wideband Threat System  
WSMR – White Sands Missile Range



# Targets, UAVS & Range Operations Symposium & Exhibition

## *Some Enabling Technologies*

Brad Westphal

October 26, 2011

**Honeywell**

## Agenda

- Budget impacts and macro environment
- Platforms and positions
- Technology portfolio
- Selected products and technology
- Conclusion

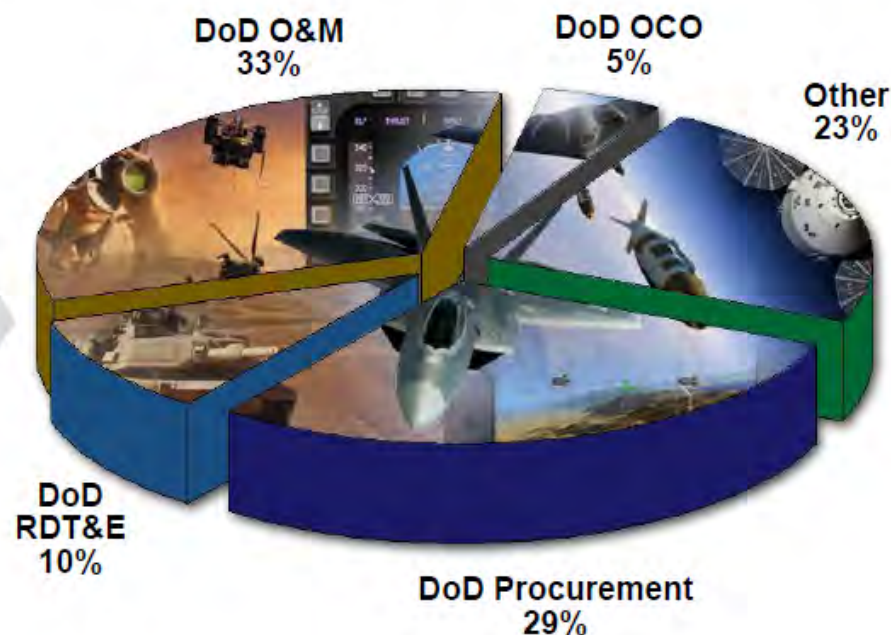
## Defense Outlook & Budget Impacts\*

### DEFENSE BUDGET TRENDS

U.S. Area of Interest	'12-16E CAGR	HON Exposure
O&M	+1 to 3%	+++
OCO	-20 to -25%	+
Procurement	-4 to -6%	++
RDT&E	-10 to -12%	+

Int'l Area of Interest	'12-16E CAGR	HON Exposure
O&M	+2 to 4%	+
Procurement	+3 to 6%	++
Net Total	Flat to +3%	+

### HONEYWELL DEFENSE REVENUE MIX



\*Management Estimates

*Modest Exposure To Declining OCO and RDT&E Budget;  
International Opportunity*



## Strong Defense Platform Positions

### Conventional Defense & Space (Near-Peer Combatant Threats)

	<b>Fighter/Attack/Trainer Aircraft</b> 30+ platforms		<b>Human Space</b> 10+ Platforms		<b>Surface/Soldier Vehicles</b> 15+ platforms
	<b>Bomber Aircraft</b> 3 platforms		<b>DoD, Civil, and Commercial Space</b> 30+ Platforms		<b>Military Helicopters</b> 20+ platforms
	<b>Mobility/Tanker Aircraft</b> 40+ platforms		<b>Army, Navy and Air Force</b> 60+ Platforms		<b>Naval Platforms</b> 10+ platforms

### Asymmetric Threats



**Special Mission/UAV Aircraft**  
20+ platforms

### International: GROWING



**International**  
20+ Platforms

### Commercial-Related



**Commercial Helicopters**  
20+ platforms

### Services



**HTSI**  
Space, networks, comms, logistics, tech services



**FM&T**  
Specialized services & solutions

*Broad & Diverse Install Base Creates Synergy Opportunities*

## Expansive Product and Technology Portfolio

### Crew Interface



- Commercial Crew Interface & Displays
- Commercial Software Products
- Flight Management Systems
- Military Crew Interface
- Navigation Database & RNP Services

### Safety & Information Management



- Cabin Mgmt System
- Comm/Nav Radios
- DataLink/Data Mgmt & Recorders
- Long Range Communication
- Ground Proximity
- Radar
- Traffic Surveillance
- Integrated Surveillance

### Navigation Systems & Sensors



- Commercial Navigation Systems
- Defense & Space Navigation Systems
- Inertial Sensors – Accelerometers
- Inertial Sensors – Gyros
- Non-Inertial Sensors
- Magnetism & Personal Nav Systems
- Precision Landing Systems
- Radiation-Hardened Components
- Space Navigation
- Tactical Navigation Grade Systems

### Propulsion



- AGT1500
- ALF502/LF507
- CFE738
- F124/F125
- HTF7000
- HTS900
- LTS101
- T55
- TFE731
- TPE331

### Platform Systems / High Integrity Controls



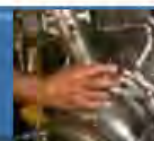
- Integrated Avionic sSystem
- T-Hawk Micro Air Vehicle
- Real-time Information in a Tactical Environment (RITE)
- Space Systems
- Electronic Eng Controls
- Flight Controls
- Space Pointing & Stabilization

### Aero Services



- Vibration Monitoring/HUMS
- Zing™ Remote
- Maintenance Services
- Flight Support Services

### Mechanical Sub Systems



- Air & Thermal Systems
- Auxiliary Power Units
- Electric Power

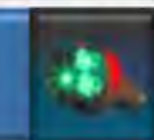
### Mechanical Components



### Wheels & Brakes



### Lighting

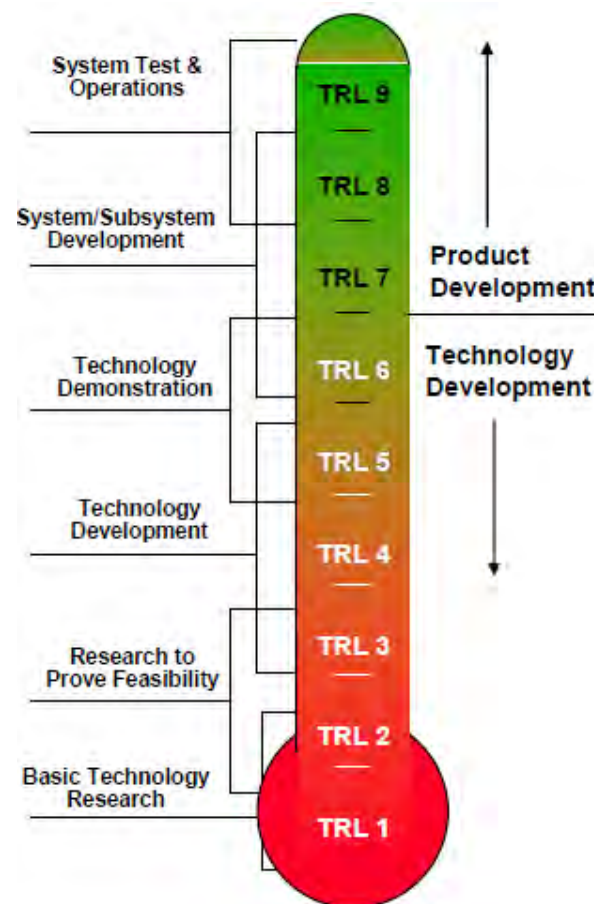


*Focused on Safety, Cost and Efficiency*



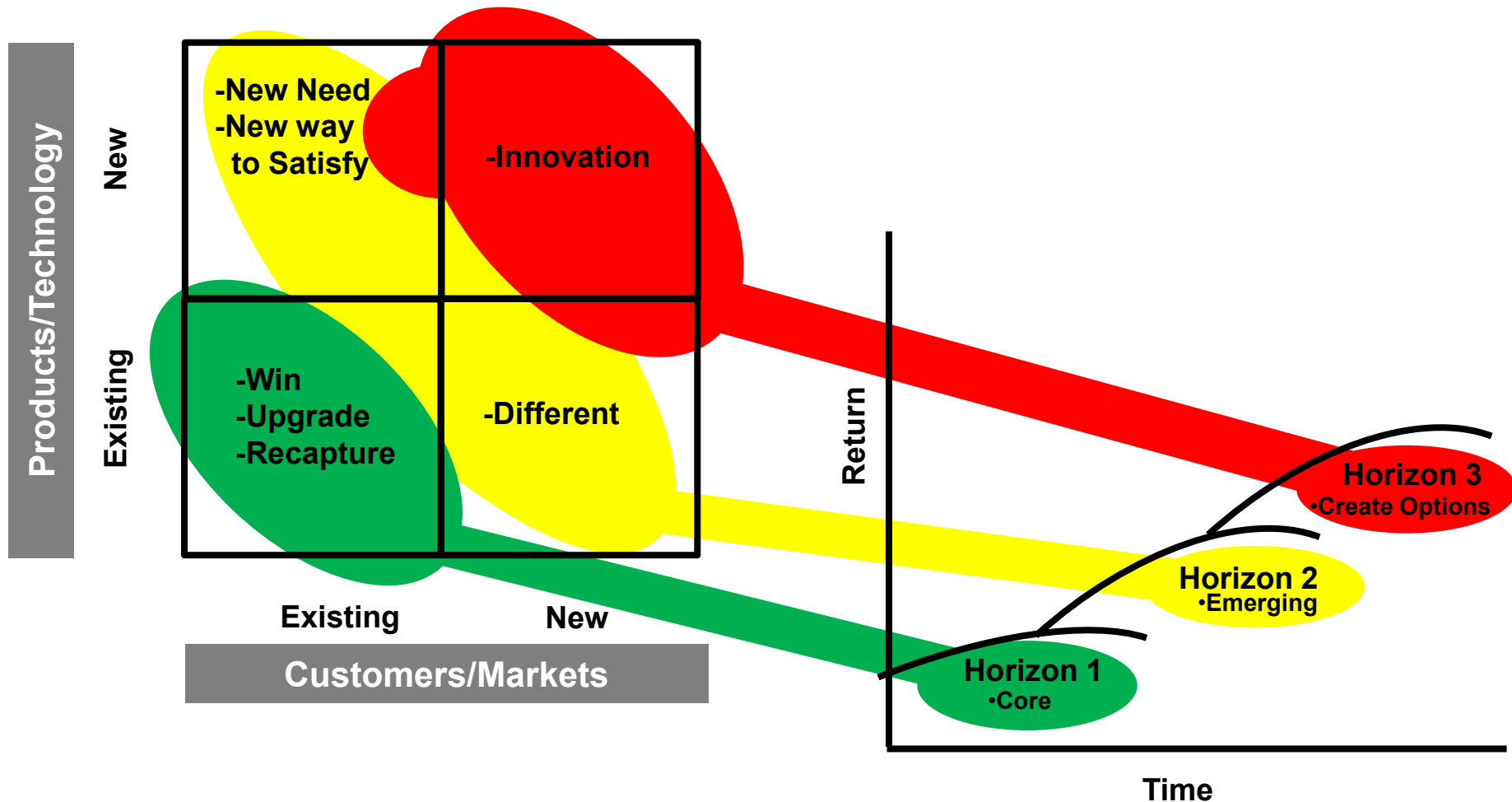
# Product and Technology Development

- Product development
  - Has clear external customers
  - Utilizes proven technologies
  - Late stage-gate development
  - Tightly connected to market opportunities
- Technology development
  - Has internal or S&T customers
  - Matures technology (TRL < 6)
  - Supports early stage-gate product development
  - Tied to market need



*Distinction Between Product & Technology Development*

## (Product) and Technology Field of Play



*Product & Technology Horizons Support Different Needs*



# (Product) and Technology Field of Play

## Horizon 1

- Core technology
- Approaching maturity
- Mild improvements
- Engineering to sustain
- Mostly existing products
- Available

## Horizon 2

- Technology differentiation
- Patentable or licensable
- New entry
- Horizon 1 replacement
- Mostly existing products
- ~TRL 4-7

## Horizon 3

- Disruptive
- Discontinuous
- Provides diversification
- Exclusive IP
- Basic/applied research
- ~TRL 1-3

*Product & Technology Horizons Support Different Needs*

## Some Enabling Products and (Technologies)

### Radar Altimeters



- 0-30,000 ft
- 28V 16W
- 59 Cu In and 3 lbs.
- RS 422 and Analog I/O

### Rate Sensors



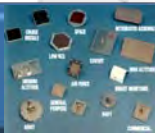
- 2 or 3 Axis
- 5V and .13 lbs.
- MEMS technology
- RS 422 Digital Output

### INS/GPS Systems



- INS/GPS Deeply Integrated
- Modular and configurable
- MEMS or RLG based
- 2.4 inches (d) x 2.5 inches (h)

### Antennas



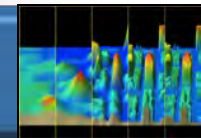
- Low-Observable and custom
- Beam shaping

### Inertial Measurement



- RLG or MEMS technology
- 5V and 15V
- 1.6 lbs to .35 lbs
- 33 Cu In. to 4 Cu In.
- RS422 Digital Interface

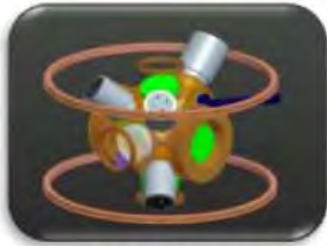
### Terrain Navigation



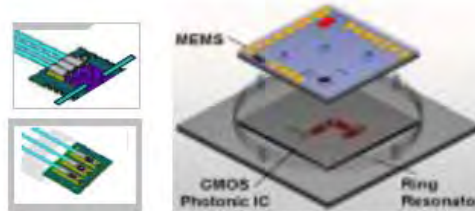
- Height above ground
- 3D position
- High speed digital processing
- Doppler beam sharpened interferometric radar altimeter
- Digital map correlation

*Horizon 1 Products & Technology Are Available*

## Growing Emerging Technologies



**Cold Atom  
Clock**



**Band Gap RFOG**



**Single Antenna  
Radar Altimeter**



**MEMS and  
System-on-Chip**



**Reaction Jet &  
Hybrid Controls**

*Growing Technologies For Evaluation and Insertion*

# R&D Yield Function

*R&D Yield =*

*$f(\text{R\&D effectivity, R\&D efficiency})$*

- R&D effectivity means working on the “right” things. This implies every technology has a path to a valued product and market.
- R&D efficiency means that we are good stewards of the funds. This implies that our project management discipline is sound (including make/buy, buy/source process for efficient application of the funds)



# System Challenges

- Keep pace with the evolution of threats
  - Evolution or revolution of vehicle capability
- Develop and enable new target capabilities
  - Enhance capabilities in guidance, navigation and control systems
- Manage and execute production
- Control cost of acquisition, operation and maintenance
  - Total life-cycle cost
  - Inventory and obsolescence

*“Do More With Less” to Overcome Challenges – 360° Collaboration*

# In Conclusion

- Technology Leadership
  - Precision Navigation, Power/Propulsion, Safety Products
- System Integration Capabilities
  - Power Management Systems, Avionics, Air Systems
- Logistics & Support
  - In-Theater Support, Asset Management, Predictive Maintenance
- Global Footprint Customer Support



***Focused On HON Core Themes: Efficiency & Safety***

*Industry Leader Committed to Innovation & Performance*

## Targets, UAVS & Range Operations Symposium & Exhibition

### *“Some Enabling Technologies”*

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